

AR TARGET SHEET

The following document was too large to scan as one unit, therefore, it has been broken down into sections.

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SECTION: 2 of 2

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TITLE: Performance Evaluation Report for
Soil Vapor Extraction Operations at
Carbon Tetrachloride Site February
1992 – September 2001

Figure C-32. Comparison of Carbon Tetrachloride Concentrations Monitored Hourly at Wells 299-W18-6L, 299-W18-247L, and 299-W18-252L, October 2000 through November 2000.

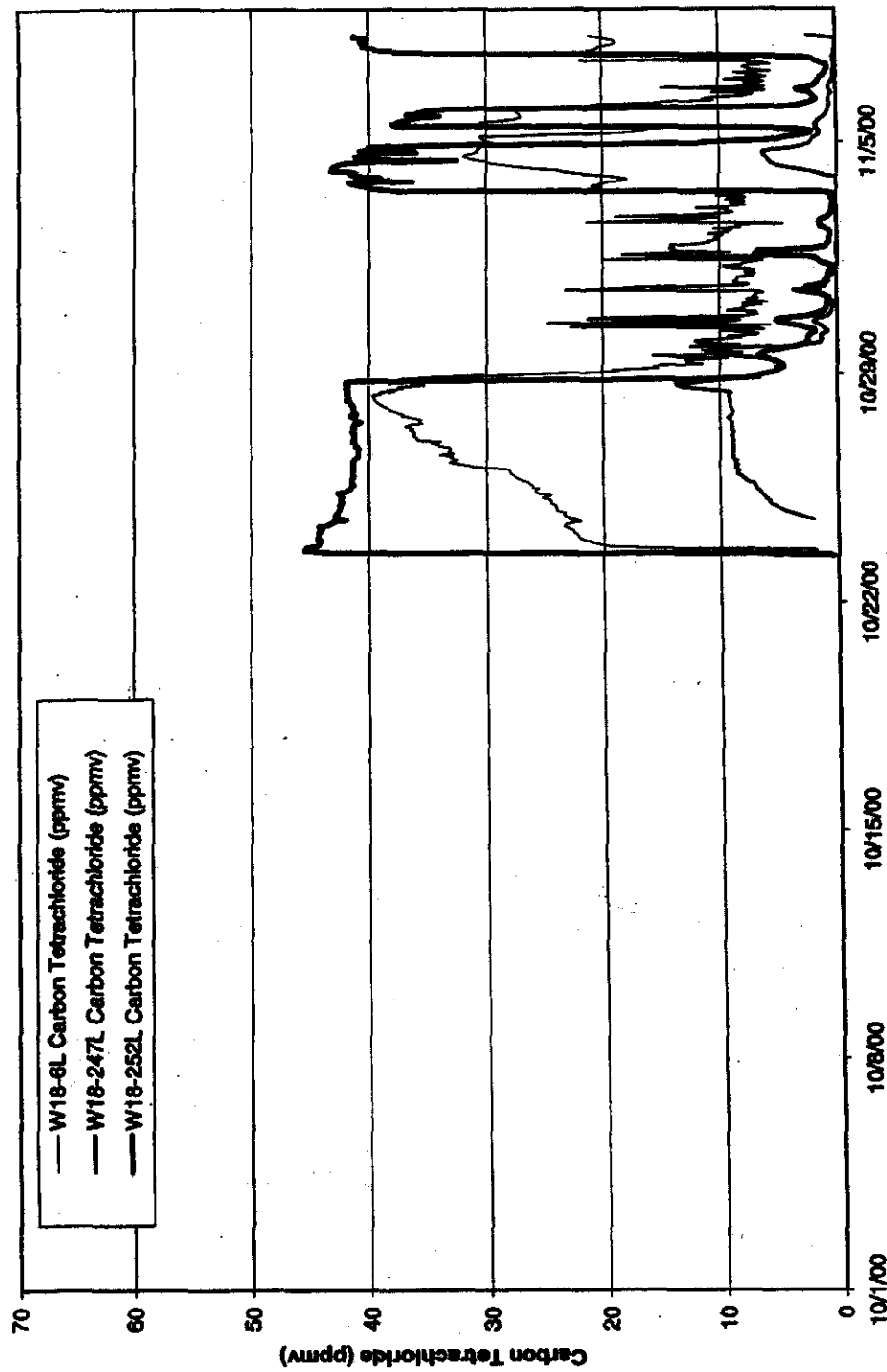


Figure C-33. Comparison of Carbon Tetrachloride Concentrations Monitored Hourly at Wells 299-W18-6L, 299-W18-247L, and 299-W18-252L, November 2000 through December 2000.

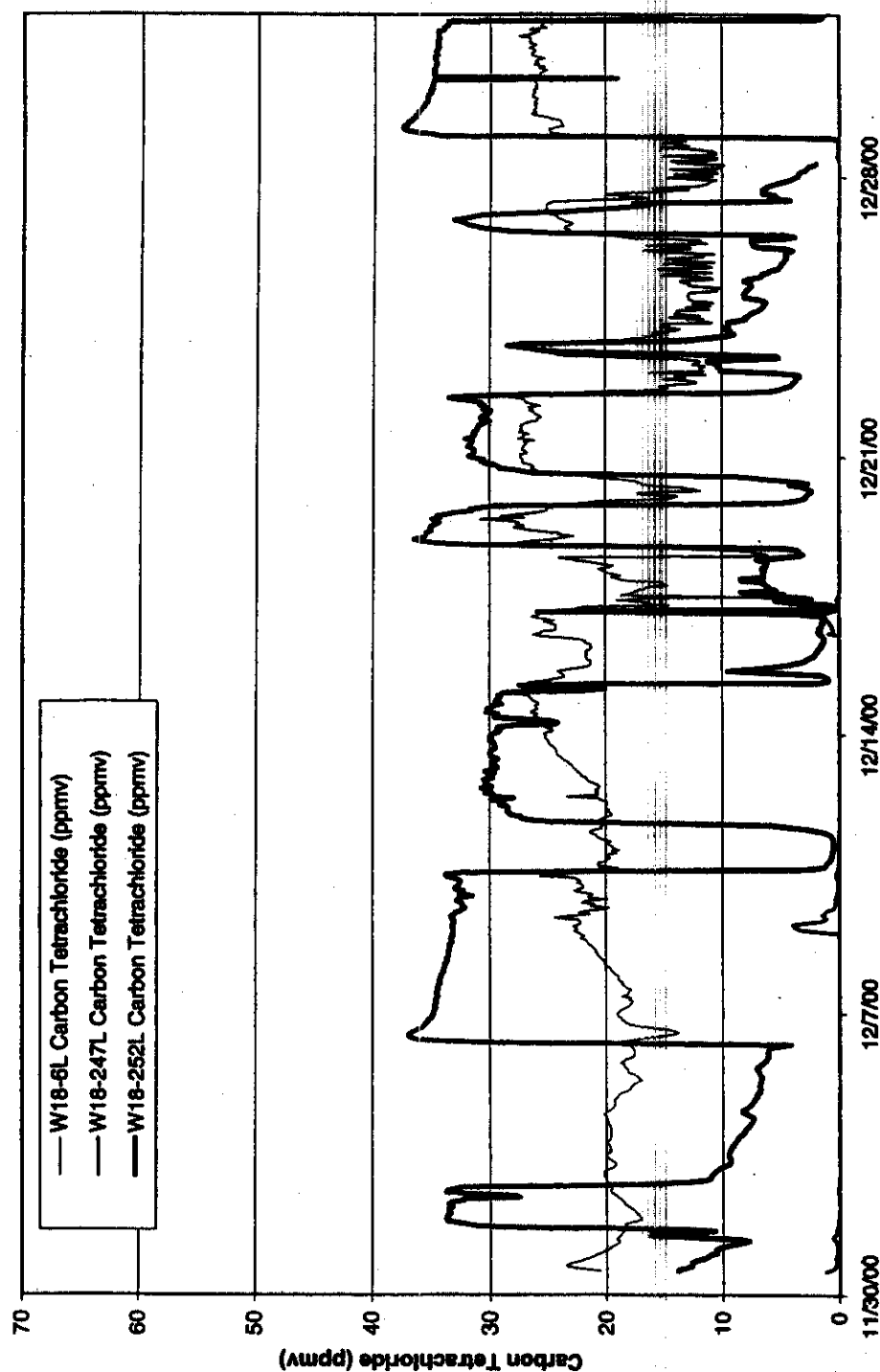


Figure C-34. Comparison of Carbon Tetrachloride Concentrations Monitored Hourly at Wells 299-W18-6L, 299-W18-247L, and 299-W18-252L, January 2001.

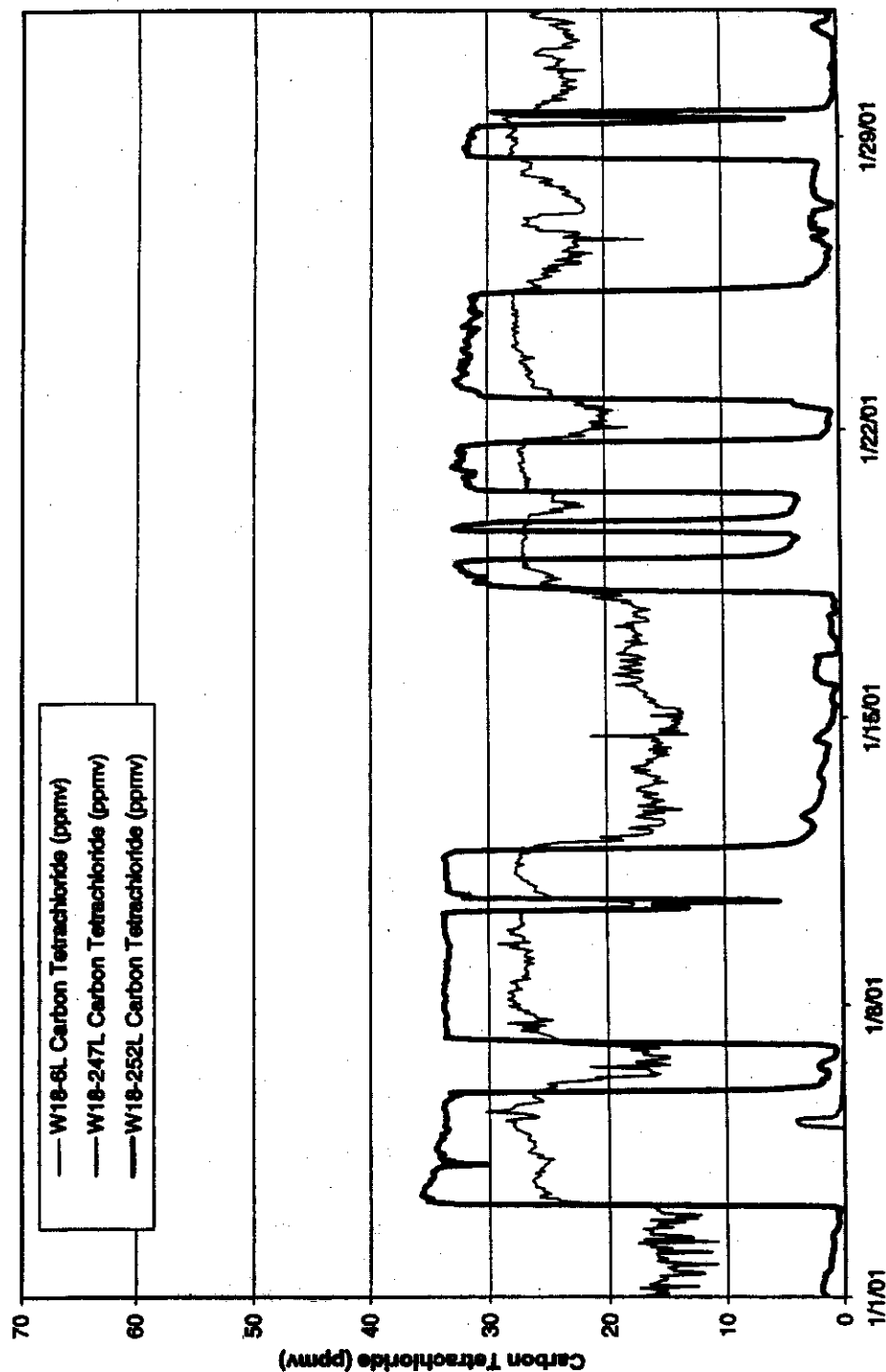


Figure C-35. Comparison of Carbon Tetrachloride Concentrations Monitored Hourly at Wells 299-W18-6L, 299-W18-247L, and 299-W18-252L, February 2001.

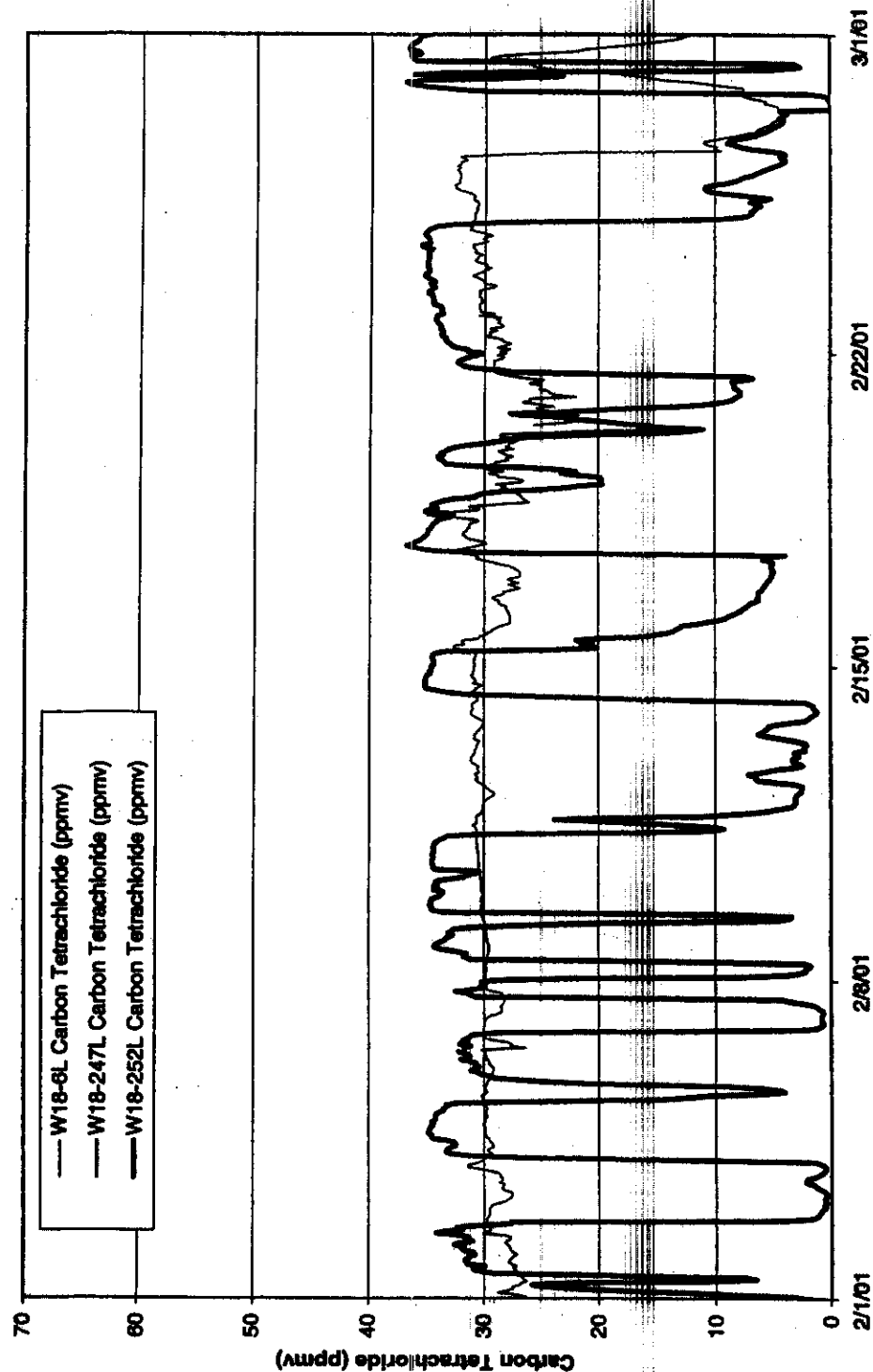


Figure C-36. Comparison of Carbon Tetrachloride Concentrations Monitored Hourly at Wells 299-W18-6L, 299-W18-247L, and 299-W18-252L, March 2001 through April 2001.

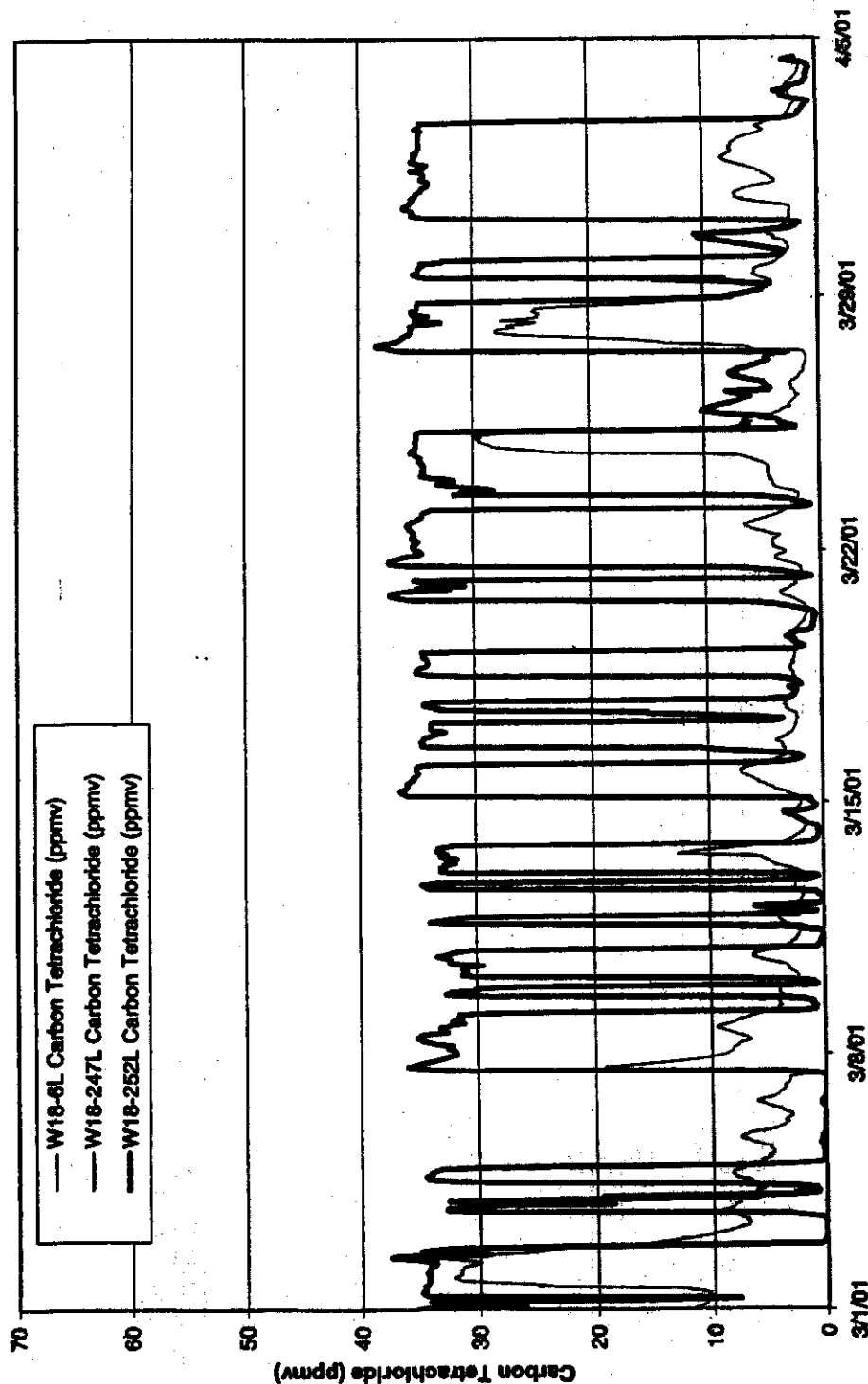


Table C-1. Data for GAC Cartridge Samples Collected from PSVE Systems, October 1999.

Well No.	GAC Collection (Date/Time)	HEIS Number	Weight of Clean GAC When Installed on Well* (kg)	Weight of Used GAC When Collected from Well (kg)	Water Content of GAC When Collected from Well	GAC Analytical Results for Solids (%)	GAC Analytical Results for Carbon Tetrachloride (µg/kg)	Carbon Tetrachloride Extracted 10/14/99-10/28/99 (g)	Comments
W18-6L	10/28/1999 9:45	B0WV21	0.45	—	—	71.1	4,600,000	2.91	—
W18-7	10/26/1999 14:20	B0WV18	0.45	—	Dry	76.8	1,800,000	1.05	—
W18-10L	10/26/1999 14:20	B0WV17	0.45	—	Moist	57.7	1,100,000	0.86	No organic vapor detectable by IHL
W18-11L	10/28/1999 12:15	B0WV23	0.45	—	Dry	82.6	1,600,000	0.87	—
W18-12	—	—	—	—	—	—	—	—	Not yet set up with GAC cartridge.
W18-246L	10/28/1999 9:45	B0WV20	0.45	—	Wet	53.0	1,600,000	1.36	Water is present when cartridge is opened.
W18-247L	10/28/1999 8:20	B0WV19	0.45	—	Dry	89.7	1,500,000	0.75	—
W18-252L	10/28/1999 11:05	B0WV22	0.45	—	Wet	52.1	2,200,000	1.90	—
Clean GAC	10/28/1999	B0WV24	0.45	—	Dry	88.0	1,200,000	0.61	GAC contains flecks of oxidized iron from the drum.

NOTE: The method blanks contained the common laboratory contaminants methylene chloride and acetone at levels less than 2X the Contract-Required Quantitation Limit (CRQL) and the target compound 2-butanone at levels less than the CRQL. (Analytical Laboratory Report)

* Based on two used, "dry" GAC samples that weighed 0.45 kg on 1/27/00.

Table C-2. Analytical Data for GAC Cartridge Samples Collected from PSVE Systems, October 1999.

Well No.	GAC Collection (Date/Time)	HEIS Number	GAC Analytical Results for Total Chloride* (mg/kg)	Sum of VOAs (mg/kg)	GAC Analytical Results for Carbon Tetrachloride* (µg/kg)	GAC Analytical Results for Chloroform* (µg/kg)	GAC Analytical Results for Methylene Chloride* (µg/kg)	GAC Analytical Results for Trichloroethene* (µg/kg)	GAC Analytical Results for Acetone* (µg/kg)
W18-6L	10/28/1999 9:45	B0WV21	8,260	5,003	4,600,000	83,800 J	320,000 B	—	—
W18-7	10/26/1999 14:20	B0WV18	1,650	2,031	1,800,000	55,000 J	160,000 B	16,000 J	—
W18-10L	10/26/1999 14:20	B0WV17	105	1,321	1,100,000	21,000 J	200,000 B	—	—
W18-11L	10/28/1999 12:15	B0WV23	1,430	1,725	1,600,000	15,000 J	110,000 B	—	—
W18-12	—	—	—	—	—	—	—	—	—
W18-246L	10/28/1999 9:45	B0WV20	357	1,808	1,600,000	38,000 J	170,000 B	—	—
W18-247L	10/28/1999 8:20	B0WV19	1,510	1,667	1,500,000	15,000 J	100,000 B	—	52,000 JB
W18-252L	10/28/1999 11:05	B0WV22	160	2,370	2,200,000	—	170,000 B	—	—

NOTES: W18-10L, W18-246L, W18-252L GAC samples were wet when removed from well; corresponds to low Total Chloride value.

The method blanks contained the common laboratory contaminants methylene chloride and acetone at levels less than 2X the Contract-Required Quantitation Limit (CRQL) and the target compound 2-butanone at levels less than the CRQL. (Analytical Laboratory Report)

*Total chloride values determined by bomb combustion. Results are reported on a wet weight basis.

*Volatile Organic Analyte values determined by EPA Method 8260.

B = Indicates analyte is found in the associated blank as well as in the sample.

J = Indicates an estimated value.

Appendix C – Passive Soil Vapor Extraction Data

Table C-3. Data for GAC Cartridge Samples Collected from PSVE Systems, November 1999.

Well No.	GAC Collection (Date/Time)	HEIS Number	Weight of Clean GAC When Installed on Well ^a (kg)	Weight of Used GAC When Collected from Well (kg)	Water Content of GAC When Collected from Well	GAC Analytical Results for Solids ^b (%)	GAC Analytical Results for Carbon Tetrachloride (µg/kg)	Carbon Tetrachloride Extracted 10/28/99-11/29/99 (g)	Comments
W18-6L	11/29/1999 12:08	B0X464	0.45	–	Dry	81.0	2,900,000 E	1.61	No water in the lines when the cartridge was removed at well.
W18-7	11/29/1999 11:51	B0X467	0.45	–	Wet	48.0	1,900,000 E	1.78	No water in the lines when the cartridge was removed at well.
W18-10L	11/29/1999 11:57	B0X465	0.45	–	Wet	48.0	1,300,000 E	1.22	Some water in the lines when the cartridge was removed at well.
W18-11L	11/29/1999 12:16	B0X462	0.45	–	Dry	79.0	1,700,000 E	0.97	No water in the lines when the cartridge was removed at well.
W18-12	11/29/1999 12:02	B0X468	0.45	–	Wet	51.0	3,400,000 E	3.00	Some water in the lines when the cartridge was removed at well.
W18-246L	11/29/1999 12:12	B0X463	0.45	–	Wet	47.0	2,100,000 E	2.01	Some water in the lines when the cartridge was removed at well.
W18-247L	11/29/1999 12:19	B0X461	0.45	–	Dry	82.0	1,200,000 E	0.66	No water in the lines when the cartridge was removed at well.
W18-252L	11/29/1999 12:05	B0X466	0.45	–	Dry	50.0	3,700,000 E	3.33	Some water in the lines when the cartridge was removed at well.

NOTES:

The method blanks contained the common laboratory contaminants methylene chloride and acetone at levels less than 2X the Contract-Required Quantitation Limit (CRQL) and the target compound 2-butanone at levels less than the CRQL. One method blank also contained the target compound chloroethane at a level less than the CRQL. (Analytical Laboratory Report)

On 11/29/99, samplers added clean GAC to seven cartridges to be placed on wells during the 11/29 changeout. The seven cartridges that were removed from these seven wells were sampled, refilled with clean GAC, and stored for the next changeout. The exception was W18-12. This cartridge was removed on 11/29, sampled, filled with clean GAC, and replaced back onto well W18-12 on 11/29.

^aBased on two used, "dry" GAC samples that weighed 0.45 kg on 1/27/00.

^bFrom the Tentatively Identified Compounds (TIC) sheets. % Moisture: not dec.

E = Indicates that the compound was detected beyond the calibration range and was subsequently analyzed at a dilution.

Table C-4. Data for GAC Cartridge Samples Collected from PSVE Systems, December 1999.

Well No.	GAC Collection (Date/Time)	HEIS Number	Weight of Clean GAC When Installed on Well* (kg)	Weight of GAC When Collected from Well (kg)	Water Content of GAC When Collected from Well	GAC Analytical Results for Solids (%)	GAC Analytical Results for Carbon Tetrachloride ^b (µg/kg)	Carbon Tetrachloride Extracted 11/29/99-12/28/99 (g)	Comments
W18-6L	12/28/1999	B0XB97	0.45	--	Dry	64.0	1,000,000 BD	0.70	--
W18-7	12/28/1999 11:25	B0XB95	0.45	--	Dry	62.0	680,000 BD	0.49	Well is venting. Drain approximately 10 oz. water from hoses.
W18-10L	12/28/1999 10:55	B0XB99	0.45	--	Very wet	52.0	150,000 D	0.13	Well is venting. Water inside cartridge when the cartridge was removed with approximately 1 oz. free liquid pouring out.
W18-11L	12/28/1999 10:50	B0XB80	0.45	--	Dry	77.0	430,000 BD	0.25	--
W18-12	12/28/1999 11:35	B0XB94	0.45	--	Very moist	54.0	140,000 BD	0.12	--
W18-246L	12/28/1999 11:00	B0XB98	0.45	--	Very moist	53.0	340,000 B	0.29	Well slightly venting prior to cartridge changeout. Water and ice in cartridge when the cartridge was removed. Drain approximately 20 oz. water from hoses.
W18-247L	12/28/1999 10:45	B0XB81	0.45	--	Dry	89.0	340,000 BD	0.17	--
W18-252L	12/28/1999 11:05	B0XB96	0.45	--	Dry	68.0	700,000 BD	0.46	Well is venting. Drain approximately 6 oz. water from hoses.

NOTES:

All method blanks contained the common laboratory contaminants methylene chloride and acetone at levels less than 2X the Contract-Required Quantitation Limit (CRQL).

One method blank also contained the target compound carbon tetrachloride at a level less than the CRQL. (Analytical Laboratory Report)

On 12/28/99, samplers placed previously prepared and stored GAC cartridges on seven wells. The seven cartridges that were removed from these wells were sampled, refilled with clean GAC, and stored for the next changeout. The exception was W18-12. The cartridge was removed on 12/28, sampled, filled with clean GAC, and replaced back onto well W18-12 on 12/28.

*Based on two loaded, "dry" GAC samples that weighed 0.45 kg on 1/27/00.

*Totally blank has carbon tetrachloride contamination at 1 ppb. Samples were not re-analyzed because carbon tetrachloride concentrations in samples are so much higher.

B = Indicates analyte is found in the associated blank as well as in the sample.

D = Identifies all compounds identified in an analysis at a secondary dilution factor.

Table C-5. Data for GAC Cartridge Samples Collected from PSVE Systems, January 2000.

Well No.	GAC Collection (Date/Time)	HEIS Number	Weight of Clean GAC When Installed on Well (kg)	Weight of Used GAC When Collected from Well (kg)	Water Content of GAC When Collected from Well	GAC Analytical Results for Solids ^a (%)	GAC Analytical Results for Carbon Tetrachloride ^b (µg/kg)	Carbon Tetrachloride Extracted 12/28/99-1/27/00 (g)	Comments
W18-6L	1/27/2000 12:00	B0XH10	0.45	0.499	Dry	71.0	3,100,000 D	1.96	Cartridge dry when cartridge removed.
W18-7	1/27/2000 12:15	B0XH09	0.45	0.635	Wet	53.0	900,000 D	0.76	--
W18-10L	1/27/2000 11:35	B0XH14	0.45	1.034	Wet/frozen	51.0	480,000	0.42	Cartridge contained approx 10 oz water when cartridge removed.
W18-11L	1/27/2000 11:30	B0XH13	0.45	0.454	Dry	64.0	1,000,000	0.70	--
W18-12	1/27/2000 11:40	B0XH11	0.45	0.953	Very wet	56.0	1,600,000 D	1.29	Cartridge contained approx 6-7 oz water when cartridge removed.
W18-246L	1/27/2000 11:50	B0XH08	0.45	0.726	Wet	53.0	530,000 D	0.45	Cartridge wet when cartridge removed.
W18-247L	1/27/2000 11:25	B0XH07	0.45	0.454	Dry	58.0	1,600,000	1.24	--
W18-252L	1/27/2000 12:05	B0XH12	0.45	1.220	Wet (ice and visible water)	55.0	2,300,000 D	1.88	Cartridge wet when cartridge removed.

NOTES:

The method blanks contained the common laboratory contaminants methylhexachloride at levels less than 2X the Contract-Required Quantitation Limit (CRQL).

Two method blanks also contained the target compounds 2-hexanone and 1,1,2,2-tetrachloroethane at levels less than the CRQL.

One method blank also contained the target compounds chloroethane, bromoethane, and bromoform at levels less than the CRQL. (Analytical Laboratory Report)

On 1/27/00, samples placed previously prepared and stored GAC cartridges on all eight wells.

^aBased on two used, "dry" GAC samples that weighed 0.45 kg on 1/27/00

^bFrom the Tentatively Identified Compounds (TIC) sheets "% Moisture: not det."

"Dilutions analyzed outside of holding time. All samples were extracted within required holding time. The extracts of these samples were analyzed within the holding time; however, dilutions and the associated matrix QC were analyzed outside of holding time. (Analytical Laboratory Report)

It is expected that if the package were to be validated, the validator would apply a "J" qualifier for this type of missed holding time.

D = Identifies all compounds identified in an analysis at a secondary dilution factor.

Appendix C – Passive Soil Vapor Extraction Data

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Table C-6. Data for GAC Cartridge Samples Collected from PSVE Systems, February 2000.

Well No.	GAC Collection (Date/Time)	HEIS Number	Weight of Clean GAC When Installed on Well * (kg)	Weight of Used GAC When Collected from Well (kg)	Water Content of GAC When Collected from Well	GAC Analytical Results for Solids (%)	GAC Analytical Results for Carbon Tetrachloride (µg/kg)	Carbon Tetrachloride Extracted 1/27/00-2/29/00 (g)	Comments
W18-6L	2/29/2000 9:13	B0XP47	0.45	0.907	Dry	55.8	1,200,000 E	0.97	No visible water when cartridge removed.
W18-7	2/29/2000 9:24	B0XP51	0.45	1.134	Wet	54.4	2,100,000	1.74	20 mL of water ran out when cartridge removed.
W18-10L	2/29/2000 8:57	B0XP44	0.45	1.225	Wet	71.4	870,000	0.55	Approximately 1 L of water present when cartridge removed.
W18-11L	2/29/2000 8:47	B0XP45	0.45	0.680	Dry	55.5	500,000	0.41	No visible water when cartridge removed.
W18-12	2/29/2000 9:03	B0XP46	0.45	1.814	Wet	75.8	370,000	0.22	60 mL of water ran out when cartridge removed.
W18-246L	2/29/2000 9:09	B0XP48	0.45	1.361	Wet	54.1	890,000	0.74	No visible water when cartridge removed.
W18-247L	2/29/2000 8:40	B0XP49	0.45	0.907	Dry	54.2	460,000	0.38	No visible water when cartridge removed.
W18-252L	2/29/2000 9:18	B0XP50	0.45	1.315	Wet	77.3	870,000	0.51	No visible water when cartridge removed.

NOTE: The method blanks contained the common laboratory contaminants methylene chloride and/or acetone at levels less than the Contract-Required Quantitation Limit (CRQL). (Analytical Laboratory Report)

*Based on two used, "dry" GAC samples that weighed 0.45 kg on 1/27/00.

E = Indicates that the compound was detected beyond the calibration range and was subsequently analyzed at a dilution.

Table C-7. Data for GAC Cartridge Samples Collected from PSVE Systems, May 2000.

Well No.	GAC Collection (Date/Time)	HEIS Number	Weight of Clean GAC When Installed on Well (kg)	Weight of Used GAC When Collected from Well (kg)	Water Content of GAC When Collected from Well	GAC Analytical Results for Solids (%)	GAC Analytical Results for Carbon Tetrachloride ($\mu\text{g}/\text{kg}$)	Carbon Tetrachloride Extracted 2/29/99-6/1/00 (g)	Comments
W18-6L	6/1/2000 8:56	B0XV76	0.45	0.795	Dry	77.3	3,600,000	2.10	No visible water when cartridge removed.
W18-7	6/1/2000 8:40	B0XV83	0.45	0.783	Dry	80.6	5,500,000	3.07	No visible water when cartridge removed.
W18-10L	6/1/2000 8:44	B0XV81	0.45	0.765	Dry	96.8	2,000,000	0.93	No visible water when cartridge removed.
W18-11L	6/1/2000 8:47	B0XV77	0.45	0.621	Dry	89.0	1,700,000	0.86	No visible water when cartridge removed.
W18-12	6/1/2000 8:50	B0XV79	0.45	0.676	Dry	84.5	4,400,000	2.34	No visible water when cartridge removed.
W18-246L	6/1/2000 9:00	B0XV82	0.45	0.715	Dry	80.2	13,000,000	7.29	No visible water when cartridge removed.
W18-247L	6/1/2000 9:04	B0XV78	0.45	0.668	Dry	83.5	1,900,000	1.02	No visible water when cartridge removed.
W18-252L	6/1/2000 8:54	B0XV84	0.45	0.685	Dry	80.8	4,500,000	2.51	No visible water when cartridge removed.
Clean GAC	6/1/2000	B0XV80	0.45	--	--	79.7	110,000	0.06	Sample collected from the clean GAC material that was placed in each cartridge.

*Based on two used, "dry" GAC samples that weighed 0.45 kg on 1/27/00.

Table C-8. Data for GAC Cartridge Samples Collected from PSVE Systems, June 2000.

Well No.	GAC Collection (Date/Time)	HEIS Number	Weight of Clean GAC When Installed on Well (kg)	Weight of Used GAC When Collected from Well (kg)	Water Content of GAC When Collected from Well	GAC Analytical Results for Solids (%)	GAC Analytical Results for Carbon Tetrachloride (µg/kg)	Carbon Tetrachloride Extracted 6/1/00- 6/27/00 (g)	Comments
W18-6L	6/27/2000 8:15	B0YM42	0.591	0.636	Dry	86.0	2,000,000	1.37	--
W18-7	6/27/2000 8:15	B0YM43	0.662	0.647	Dry	87.0	20,000,000	15.22	--
W18-10L	6/27/2000 8:15	B0YM44	0.625	0.593	Dry	92.0	3,700,000	2.51	--
W18-11L	6/27/2000 8:15	B0YM45	0.585	0.605	Dry	88.0	530,000	0.35	--
W18-12	6/27/2000 8:15	B0YM46	0.613	0.585	Dry	90.9	25,000,000	16.86	--
W18-246L	6/27/2000 8:15	B0YM47	0.694	0.679	Dry	80.4	28,000,000	24.17	--
W18-247L	6/27/2000 8:15	B0YM48	0.645	0.607	Dry	85.8	2,700,000	2.03	--
W18-252L	6/27/2000 8:15	B0YM49	0.633	0.610	Dry	93.6	13,000,000	8.79	--

Table C-9. Data for GAC Cartridge Samples Collected from PSVE Systems, July 2000.

Well No.	GAC Collection (Date/Time)	HEIS Number	Weight of Clean GAC When Installed on Well (kg)	Weight of Used GAC When Collected from Well (kg)	Water Content of GAC When Collected from Well	GAC Analytical Results for Solids (%)	GAC Analytical Results for Carbon Tetrachloride (µg/kg)	Carbon Tetrachloride Extracted 6/27/00-7/31/00 (g)	Comments
W18-6L	7/31/2000 6:15	B0YW25	0.650	0.637	Dry	94.8	3,400,000	2.33	--
W18-7	7/31/2000 6:15	B0YW26	0.651	0.695	Dry	90.2	52,000,000	37.53	--
W18-10L	7/31/2000 6:15	B0YW27	0.650	0.634	Dry	94.5	3,900,000	2.68	--
W18-11L	7/31/2000 6:15	B0YW28	0.617	0.596	Dry	98.5	2,400,000	1.50	--
W18-12	7/31/2000 6:15	B0YW29	0.590	0.664	Dry	85.8	25,000,000	17.19	--
W18-246L	7/31/2000 6:15	B0YW30	0.518	0.660	Dry	90.2	27,000,000	15.51	--
W18-247L	7/31/2000 6:15	B0YW31	0.600	0.596	Dry	97.2	1,700,000	1.05	--
W18-252L	7/31/2000 6:15	B0YW32	0.577	0.615	Dry	95.8	7,000,000	4.22	--

Table C-10. Data for GAC Cartridge Samples Collected from PSVE Systems, August 2000.

Well No.	GAC Collection (Date/Time)	HEIS Number	Weight of Clean GAC When Installed on Well (kg)	Weight of Used GAC When Collected from Well (kg)	Water Content of GAC When Collected from Well	GAC Analytical Results for Solids (%)	GAC Analytical Results for Carbon Tetrachloride (µg/kg)	Carbon Tetrachloride Extracted 7/31/00-8/29/00 (g)	Comments
W18-6L	8/29/2000 7:40	B104N3	0.625	0.671	Dry	88.0	3,700,000	2.63	-
W18-7	8/29/2000 7:40	B104N4	0.585	0.624	Dry	93.3	3,200,000	2.01	-
W18-10L	8/29/2000 7:40	B104N5	0.623	0.619	Dry	94.8	1,900,000	1.25	-
W18-11L	8/29/2000 7:40	B104N6	0.590	0.575	Dry	93.4	300,000	0.19	-
W18-12	8/29/2000 7:40	B104N7	0.630	0.637	Dry	93.2	5,500,000	3.72	-
W18-246L	8/29/2000 7:40	B104N8	0.618	0.575	Dry	97.3	11,000,000	6.99	-
W18-247L	8/29/2000 7:40	B104N9	0.570	0.556	Dry	97.2	280,000	0.16	-
W18-252L	8/29/2000 7:40	B104P0	0.618	0.650	Dry	92.0	6,800,000	4.57	-

Table C-11. Data for GAC Cartridge Samples Collected from PSVE Systems, September 2000.

Well No.	GAC Collection (Date/Time)	HEIS Number	Weight of Clean GAC When Installed on Well (kg)	Weight of Used GAC When Collected from Well (kg)	Water Content of GAC When Collected from Well	GAC Analytical Results for Solids (%)	GAC Analytical Results for Carbon Tetrachloride (µg/kg)	Carbon Tetrachloride Extracted 8/29/00-9/27/00 (g)	Comments
W18-6L	9/27/2000 10:14	B10F00	0.723	0.873	Dry	79.9	3,900,000	3.53	-
W18-7	9/27/2000 10:14	B10F06	0.585	0.914	Wet	60.4	1,000,000	0.97	-
W18-10L	9/27/2000 10:14	B10F05	0.709	0.875	Dry	76.2	1,700,000	1.58	-
W18-11L	9/27/2000 10:14	B10F03	0.663	0.603	Dry	99.5	100,000	0.07	-
W18-12	9/27/2000 10:14	B10F02	0.550	0.641	Dry	89.1	9,800,000	6.05	-
W18-246L	9/27/2000 10:14	B10DY9	0.574	0.570	Dry	97.9	750,000	0.44	-
W18-247L	9/27/2000 10:14	B10F04	0.600	0.662	Dry	88.7	510,000	0.34	-
W18-252L	9/27/2000 10:14	B10F01	0.584	0.633	Dry	88.8	4,000,000	2.63	-

Table C-12. Data for GAC Cartridge Samples Collected from PSVE Systems, October 2000.

Well No.	GAC Collection (Date/Time)	HEIS Number	Weight of Clean GAC When Installed on Well (kg)	Weight of Used GAC When Collected from Well (kg)	Water Content of GAC When Collected from Well	GAC Analytical Results for Solids (%)	GAC Analytical Results for Carbon Tetrachloride (µg/kg)	Carbon Tetrachloride Extracted 9/27/00-10/31/00 (g)	Comments
W18-6L	10/31/2000 11:45	B10M30	0.569	0.705	Dry	63.3	6,200,000	5.57	--
W18-7	10/31/2000 11:45	B10M31	0.568	0.961	Wet	57.8	2,200,000	2.16	--
W18-10L	10/31/2000 11:45	B10M32	0.642	1.339	Wet	55.4	1,300,000	1.51	--
W18-11L	10/31/2000 11:45	B10M33	0.555	0.542	Dry	98.0	20,000	0.01	--
W18-12	10/31/2000 11:45	B10M34	0.545	1.045	Wet	57.3	3,400,000	3.23	--
W18-246L	10/31/2000 11:45	B10M35	0.620	1.088	Wet	58.2	220,000	0.23	--
W18-247L	10/31/2000 11:45	B10M36	0.545	0.743	Dry	73.6	610,000	0.45	--
W18-252L	10/31/2000 11:45	B10M37	0.590	0.736	Dry	76.5	10,000,000	7.71	--

Table C-13. Data for GAC Cartridge Samples Collected from PSVE Systems, November 2000.

Well No.	GAC Collection (Date/Time)	HEIS Number	Weight of Clean GAC When Installed on Well (kg)	Weight of Used GAC When Collected from Well (kg)	Water Content of GAC When Collected from Well	GAC Analytical Results for Solids (%)	GAC Analytical Results for Carbon Tetrachloride (µg/kg)	Carbon Tetrachloride Extracted 10/31/00-11/29/00 (g)	Comments
W18-6L	11/29/2000 9:15	B111D7	0.589	0.639	Dry	88.6	1,400,000	0.93	--
W18-7	11/29/2000 9:15	B111D8	0.528	1.151	Wet	55.2	2,000,000	1.91	--
W18-10L	11/29/2000 9:15	B111D9	0.500	1.071	Wet	55.7	840,000	0.75	--
W18-11L	11/29/2000 9:15	B111F0	0.517	0.508	Dry	94.8	78,000	0.04	--
W18-12	11/29/2000 9:15	B111F1	0.486	1.127	Wet	48.3	1,700,000	1.71	--
W18-246L	11/29/2000 9:15	B111F2	0.521	1.162	Wet	55.6	92,000	0.09	--
W18-247L	11/29/2000 9:15	B111F3	0.530	0.551	Dry	92.2	180,000	0.10	--
W18-252L	11/29/2000 9:15	B111F4	0.541	1.129	Wet	57.0	2,400,000	2.28	--

Table C-14. Data for GAC Cartridge Samples Collected from PSVE Systems, December 2000.

Well No.	GAC Collection (Date/Time)	HEIS Number	Weight of Clean GAC When Installed on Well (kg)	Weight of Used GAC When Collected from Well (kg)	Water Content of GAC When Collected from Well	GAC Analytical Results for Solids (%)	GAC Analytical Results for Carbon Tetrachloride (µg/kg)	Carbon Tetrachloride Extracted 11/29/00-12/27/00 (g)	Comments
W18-6L	12/27/2000 7:30	B116W8	0.618	0.623	Dry	94.4	38,000	0.02	--
W18-7	12/27/2000 7:30	B116W9	0.570	1.120	Frozen	57.2	4,000,000	3.99	Carbon is frozen solid inside of the cartridge. Chipped GAC sample for analysis.
W18-10L	12/27/2000 7:30	B116X0	0.620	1.355	Frozen	56.2	2,200,000	2.43	Carbon is frozen solid inside of the cartridge. Chipped GAC sample for analysis.
W18-11L	12/27/2000 7:30	B116X1	0.610	0.607	Dry	95.2	22,000	0.01	--
W18-12	12/27/2000 7:30	B116X2	0.530	1.370	Frozen	38.0	2,400,000	3.35	Carbon is frozen solid inside of the cartridge. Chipped GAC sample for analysis.
W18-246L	12/27/2000 7:30	B116X3	0.630	1.430	Frozen	40.0	210,000	0.33	Carbon is frozen solid inside of the cartridge. Chipped GAC sample for analysis.
W18-247L	12/27/2000 7:30	B116X4	0.550	0.564	Dry	93.6	23,000	0.01	--
W18-252L	12/27/2000 7:30	B116X5	0.580	1.356	Frozen	52.2	1,100,000	1.22	Carbon is frozen solid inside of the cartridge. Chipped GAC sample for analysis.

Table C-15. Data for GAC Cartridge Samples Collected from PSVE Systems, January 2001.

Well No.	GAC Collection (Date/Time)	HEIS Number	Weight of Clean GAC When Installed on Well (kg)	Weight of Used GAC When Collected from Well (kg)	Water Content of GAC When Collected from Well	GAC Analytical Results for Solids (%)	GAC Analytical Results for Carbon Tetrachloride (µg/kg)	Carbon Tetrachloride Extracted 12/27/00-1/29/01 (g)	Comments
W18-6L	1/29/2001 8:45	B11BW8	0.612	0.640	Dry	95.9	13,000	0.01	old clean GAC loaded in cartridge and stored for next changeout.
W18-7	1/29/2001 8:45	B11BW9	0.567	1.595	Water	36.6	43,000	0.07	old clean GAC loaded in cartridge and stored for next changeout.
W18-10L	1/29/2001 8:45	B11BX0	0.597	1.367	Saturated, partly frozen	36.9	44,000	0.07	old clean GAC loaded in cartridge and stored for next changeout.
W18-11L	1/29/2001 8:45	B11BX1	0.494	0.493	Dry	95.9	19,000	0.01	old clean GAC loaded in cartridge and stored for next changeout.
W18-12	1/29/2001 8:45	B11BX2	0.508	1.215	Frozen	40.4	35,000	0.04	new clean GAC loaded in cartridge and stored for next changeout.
W18-246L	1/29/2001 8:45	B11BX3	0.507	1.104	Frozen	58.3	140,000	0.12	new clean GAC loaded in cartridge and stored for next changeout.
W18-247L	1/29/2001 8:45	B11BX4	0.491	0.506	Dry	90.7	54,000	0.03	new clean GAC loaded in cartridge and stored for next changeout.
W18-252L	1/29/2001 8:45	B11BX5	0.548	0.910	Part frozen	57.8	2,100,000	1.99	new clean GAC loaded in cartridge and stored for next changeout.

NOTES:

Non-target compounds were detected in the method blank.

Previous supply of clean GAC used up; new supply of clean GAC obtained. Old GAC observed to be finer-grained than new GAC.

New GAC obtained from regenerated GAC.

Table C-16. Data for GAC Cartridge Samples Collected from PSVE Systems, February 2001.

Well No.	GAC Collection (Date/Time)	HEIS Number	Weight of Clean GAC When Installed on Well (kg)	Weight of Used GAC When Collected from Well (kg)	Water Content of GAC When Collected from Well	GAC Analytical Results for Solids (%)	GAC Analytical Results for Carbon Tetrachloride (µg/kg)	Carbon Tetrachloride Extracted 1/29/01-2/27/01 (g)	Comments
W18-6L	2/27/2001 8:10	B11JL4	0.580	0.603	Dry	95.5	9,800	0.01	--
W18-7	2/27/2001 8:10	B11JL5	0.604	0.990	Frozen/Wet	59.5	4,500,000	4.57	--
W18-10L	2/27/2001 8:10	B11JL6	0.580	1.149	Wet Frozen	59.4	1,400,000	1.37	--
W18-11L	2/27/2001 8:10	B11JL7	0.610	0.609	Dry	93.9	16,000	0.01	--
W18-12	2/27/2001 8:10	B11JL8	0.575	0.795	Dry	68.6	2,800,000	2.35	--
W18-246L	2/27/2001 8:10	B11JL9	0.594	1.185	Frozen	55.7	81,000	0.09	--
W18-247L	2/27/2001 8:10	B11JM0	0.565	0.581	Dry	93.5	4,500	0.00	--
W18-252L	2/27/2001 8:10	B11JM1	0.590	1.003	Frozen	58.7	1,500,000	1.51	--

Table C-17. Data for GAC Cartridge Samples Collected from PSVE Systems, March 2001.

Well No.	GAC Collection (Date/Time)	HEIS Number	Weight of Clean GAC When Installed on Well* (kg)	Weight of Used GAC When Collected from Well (kg)	Water Content of GAC When Collected from Well	GAC Analytical Results for Solids (%)	GAC Analytical Results for Carbon Tetrachloride (µg/kg)	Carbon Tetrachloride Extracted 2/27/01-3/26/01 (g)	Comments
W18-6L	3/26/2001 8:45	B11LB3	0.586	0.602	Dry	91.5	4,700	0.00	--
W18-7	3/26/2001 8:45	B11LB4	0.560	0.938	Wet	58.5	1,500,000	1.44	--
W18-10L	3/26/2001 8:45	B11LB5	0.550	0.872	Wet	59.2	600,000	0.56	--
W18-11L	3/26/2001 8:45	B11LB6	0.538	0.526	Dry	97.3	4,500	0.00	Broken hose, first noticed on 3/26/01. Hose repaired 4/9/01.
W18-12	3/26/2001 8:45	B11LB7	0.478	0.660	Dry	72.2	3,000,000	1.99	--
W18-246L	3/26/2001 8:45	B11LB8	0.465	0.690	Dry	67.7	1,100,000	0.76	Broken hose, first noticed on 3/8/01. By 3/21/01, hose had been repaired. Hose broken again, noticed on 3/26/01. Hose repaired 4/9/01.
W18-247L	3/26/2001 8:45	B11LB9	0.458	0.463	Dry	96.0	20,000	0.01	--
W18-252L	3/26/2001 8:45	B11LC0	0.583	0.475	Dry	73.2	1,000,000	0.80	--
Clean GAC	3/26/2001	B11LC1	0.527	--	Dry	97.6	210 J	0.00	--

*Dry weight assigned to clean GAC is average of dry weights for eight wells.
J = Indicates an estimated value.

Table C-18. Data for GAC Cartridge Samples Collected from PSVE Systems, April 2001.

Well No.	GAC Collection (Date/Time)	HEIS Number	Weight of Clean GAC When Installed on Well (kg)	Weight of Used GAC When Collected from Well (kg)	Water Content of GAC When Collected from Well	GAC Analytical Results for Solids (%)	GAC Analytical Results for Carbon Tetrachloride (µg/kg)	Carbon Tetrachloride Extracted 3/26/01-4/30/01 (g)	Comments
W18-6L	4/30/2001 9:20	B11XP6	0.475	0.464	Dry	92.2	370,000	0.19	--
W18-7	4/30/2001 9:20	B11XP7	0.523	0.744	Dry	69.3	9,400,000	7.09	--
W18-10L	4/30/2001 9:20	B11XP8	0.501	0.726	Dry	69.7	3,600,000	2.59	--
W18-11L	4/30/2001 9:20	B11XP9	0.497	0.493	Dry	95.6	570,000	0.30	--
W18-12	4/30/2001 9:20	B11XR0	0.498	0.670	Dry	73.7	11,000,000	7.43	--
W18-246L	4/30/2001 9:20	B11XR1	0.468	0.645	Dry	73.2	7,200,000	4.60	--
W18-247L	4/30/2001 9:20	B11XR2	0.475	0.483	Dry	95.4	8,900 J	0.00	--
W18-252L	4/30/2001 9:20	B11XR3	0.472	0.649	Dry	72.8	5,900,000	3.83	--

J = Indicates an estimated value.

Table C-19. Data for GAC Cartridge Samples Collected from PSVE Systems, May 2001.

Well No.	GAC Collection (Date/Time)	HEIS Number	Weight of Clean GAC When Installed on Well (kg)	Weight of Used GAC When Collected from Well (kg)	Water Content of GAC When Collected from Well	GAC Analytical Results for Solids (%)	GAC Analytical Results for Carbon Tetrachloride (µg/kg)	Carbon Tetrachloride Extracted 4/30/01-5/30/01 (g)	Comments
W18-6L	5/30/2001 8:26	B124R7	0.486	0.606	Dry	89.7	27,000,000	14.63	--
W18-7	5/30/2001 8:26	B124R8	0.508	0.680	Dry	89.2	18,000,000	10.99	--
W18-10L	5/30/2001 8:26	B124R9	0.512	0.613	Dry	90.7	12,000,000	6.77	--
W18-11L	5/30/2001 8:26	B124T0	0.536	0.512	Dry	99.3	63,000	0.03	--
W18-12	5/30/2001 8:26	B124T1	0.486	0.593	Dry	89.3	23,000,000	12.52	--
W18-246L	5/30/2001 8:26	B124T2	0.495	0.542	Dry	99.9	8,200,000	4.06	0.5 in. less carbon. Screen was pushed out on bottom approximately 0.5 in.
W18-247L	5/30/2001 8:26	B124T3	0.494	0.509	Dry	99.6	2,700,000	1.34	--
W18-252L	5/30/2001 8:26	B124T4	0.475	0.533	Dry	93.1	7,100,000	3.62	Clean GAC weight recorded 6/26/01; GAC removed from cartridge and weighed before placing cartridge on well.

NOTES:

Non-target compounds were detected in the samples.

One of two matrix spike recoveries was outside EPA QC limits due to large concentration found in the unspiked sample and non-homogeneous sample matrix. (Analytical Laboratory Report)

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Table C-20. Analytical Data for GAC Cartridge Samples Collected from PSVE Systems, June 2001.

Well No.	GAC Collection (Date/Time)	HEIS Number	Weight of Clean GAC When Installed on Well (kg)	Weight of Used GAC When Collected from Well (kg)	Water Content of GAC When Collected from Well	GAC Analytical Results for Solids (%)	GAC Analytical Results for Carbon Tetrachloride (µg/kg)	Carbon Tetrachloride Extracted 5/29/01-6/26/01 (g)	Comments
W18-6L	6/26/2001 8:57	B129F5	0.472	0.645	Dry	77.8	17,000,000	10.31	-
W18-7	6/26/2001 8:57	B129F6	0.487	0.484	Dry	98.3	1,600,000	0.79	-
W18-10L	6/26/2001 8:57	B129F7	0.491	0.602	Dry	84.3	2,100,000	1.22	-
W18-11L	6/26/2001 8:57	B129F8	0.485	0.494	Dry	97.7	93,000	0.05	-
W18-12	6/26/2001 8:57	B129F9	0.467	0.579	Dry	80.9	13,000,000	7.50	-
W18-246L	6/26/2001 8:57	B129H0	0.478	0.548	Dry	88.2	13,000,000	7.05	-
W18-247L	6/26/2001 8:57	B129H1	0.454	0.538	Dry	82.0	3,000,000	1.66	-
W18-252L	6/26/2001 8:57	B129H2	0.470	0.471	Dry	97.8	1,500,000	0.72	-

NOTES:

W18-7 taken off-line from passive system on 5/31/01. W18-7 placed on-line to active soil vapor extraction system from 5/31/01 to 7/18/01.
W18-12 and W18-246L taken off-line from passive systems on 6/5/01. W18-12 GAC in 55 gal drum estimated.
W18-246L GAC in 55 gal drum could not be tested for saturation and taken off-line as precaution.

Table C-21. Data for GAC Cartridge Samples Collected from PSVE Systems, July 2001.

Well No.	GAC Collection (Date/Time)	HEIS Number	Weight of Clean GAC When Installed on Well (kg)	Weight of Used GAC When Collected from Well (kg)	Water Content of GAC When Collected from Well	GAC Analytical Results for Solids (%)	GAC Analytical Results for Carbon Tetrachloride (ug/kg)	Carbon Tetrachloride Extracted 6/26/01-7/30/01 (g)	Comments
W18-6L	7/30/2001 10:00	B12JY5	0.472	0.520	Dry	90.1	24,000,000 D	12.57	--
W18-7	7/30/2001 10:00	B12JY6	0.490	0.484	Dry	98.8	99,000 JD	0.05	--
W18-10L	7/30/2001 10:00	B12JY7	0.472	0.492	Dry	95.6	6,200,000 D	3.06	--
W18-11L	7/30/2001 10:00	B12JY8	0.476	0.469	Dry	99.8	250,000	0.12	--
W18-12	7/30/2001 10:00	B12JY9	0.464	0.459	Dry	99.1	17,000	0.01	--
W18-246L	7/30/2001 10:00	B12K00	0.454	0.445	Dry	99.6	150,000	0.07	--
W18-247L	7/30/2001 10:00	B12K01	0.462	0.473	Dry	97.1	15,000	0.01	--
W18-252L	7/30/2001 10:00	B12K02	0.452	0.509	Dry	88.5	16,000,000 D	8.17	--

NOTES:

W18-7: Blank off-line from passive system on 5/21/01.

W18-12 and W18-246L: Blank off-line from passive system on 6/30/01.

D = Identifies all compounds identified in an analysis at a secondary dilution factor.

J = Indicates an estimated value.

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Table C-22. Data for GAC Cartridge Samples Collected from PSVE Systems, August 2001.

Well No.	GAC Collection (Date/Time)	HEIS Number	Weight of Clean GAC When Installed on Well (kg)	Weight of Used GAC When Collected from Well (kg)	Water Content of GAC When Collected from Well	GAC Analytical Results for Solids (%)	GAC Analytical Results for Carbon Tetrachloride (µg/kg)	Carbon Tetrachloride Extracted 7/30/01-8/30/01 (g)	Comments
W18-6L	8/30/2001 8:15	B12V04	0.480	0.518	Dry	90.1	13,000,000 D	6.93	--
W18-7	--	--	--	--	--	--	--	--	Off-line from passive system; GAC not sampled.
W18-10L	8/30/2001 8:15	B12V05	0.485	0.494	Dry	96.0	5,400,000 D	2.73	--
W18-11L	8/30/2001 8:15	B12V06	0.465	0.451	Dry	99.8	480,000 D	0.22	--
W18-12	--	--	--	--	--	--	--	--	Off-line from passive system; GAC not sampled.
W18-246L	--	--	--	--	--	--	--	--	Off-line from passive system; GAC not sampled.
W18-247L	8/30/2001 8:15	B12V07	0.465	0.475	Dry	96.3	1,100,000 D	0.53	--
W18-252L	8/30/2001 8:15	B12V08	0.464	0.573	Dry	81.7	13,000,000 D	7.38	--

NOTES:

W18-7 taken off-line from passive system on 5/31/01.

W18-12 and W18-246L taken off-line from passive systems on 6/5/01.

D = Identifies all compounds identified in an analysis at a secondary dilution factor.

Table C-23. Data for GAC Cartridge Samples Collected from PSVE Systems, September 2001.

Well No.	GAC Collection (Date/Time)	HEIS Number	Weight of Clean GAC When Installed on Well (kg)	Weight of Used GAC When Collected from Well (kg)	Water Content of GAC When Collected from Well	GAC Analytical Results for Solids (%)	GAC Analytical Results for Carbon Tetrachloride (µg/kg)	Carbon Tetrachloride Extracted 8/30/01-9/26/01 (g)	Comments
W18-6L	9/26/2001 10:00	B13296	0.487	0.615	Dry	80.2	3,300,000	2.00	--
W18-7	--	--	--	--	--	--	--	--	Off-line from passive system; GAC not sampled.
W18-10L	9/26/2001 10:00	B13297	0.462	0.517	Dry	84.8	1,900,000	1.04	--
W18-11L	9/26/2001 10:00	B13298	0.476	0.421	Dry	97.4	260,000	0.13	Used GAC weight inaccurate; GAC spilled.
W18-12	--	--	--	--	--	--	--	--	Off-line from passive system; GAC not sampled.
W18-246L	--	--	--	--	--	--	--	--	Off-line from passive system; GAC not sampled.
W18-247L	9/26/2001 10:00	B13299	0.493	0.590	Dry	79.0	2,100,000	1.31	--
W18-252L	9/26/2001 10:00	B13290	0.427	0.502	Dry	80.2	4,000,000	2.13	--

NOTES:

The method blank contained the common laboratory contaminant methylene chloride at a level less than 3X the Contract-Required Quantitation Limit (CRQL). (Analytical Laboratory Report)

W18-7 taken off-line from passive system on 5/31/01.
W18-12 and W18-246L taken off-line from passive systems on 6/5/01.

Table C-24a. Additional Analytes Detected in GAC Cartridge Samples Collected from PSVE Systems on Wells 299-W18-6L, 299-W18-7, 299-W18-10L, and 299-W18-11L, October 1999 to September 2001. (3 Pages)

Volatile Organic Compound	GAC Collection Date	W18-6L		W18-7		W18-10L		W18-11L	
		HEIS Number	Result (µg/kg) ¹	HEIS Number	Result (µg/kg) ¹	HEIS Number	Result (µg/kg) ¹	HEIS Number	Result (µg/kg) ¹
1,1-Difluoroethane	31-Jul-2000					BOYW27	10 JN	BOYW28	10 JN
1,1,2-Trichloro-1,2-Ethane	29-Jan-2000								
1,1,2,2-Tetrachloroethane	29-Feb-2000								
2-Butanone	29-Nov-1999	BOX464	250 JB					BOX462	15,000 BJ
	29-Jan-2000								
Acetone	26-28-Oct-1999								
	29-Nov-1999	BOX464	1,000 JB	BOX467	1,700 JB	BOX465	1,300 JB	BOX462	52,000 BJ
	28-Dec-1999	BOXB97	700 BJ	BOXB95	410 BJ	BOXB99	1,700 BJ	BOXBB0	370 BJ
	29-Jan-2000	BOXH10	30,000 BJ					BOXH13	32,000 BJ
	29-Feb-2000					BOXP44	92,000 BJ		
Bromodichloromethane	28-Dec-1999			BOXB95	470				
Bromofluorobenzene	29-Jan-2000	BOXH10	9,000 J						
Chloroform	26-28-Oct-1999	BOWV21	83,000 J	BOWV18	55,000 J	BOWV17	21,000 J	BOWV23	15,000 J
	29-Nov-1999	BOX464	9,400	BOX467	11,000	BOX465	2,100	BOX462	350,000
	28-Dec-1999	BOXB97	12,000	BOXB95	24,000	BOXB99	1,900 J	BOXBB0	5,800
	29-Jan-2000	BOXH10	24,000 J	BOXH09	26,000	BOXH14	31,000 J	BOXH13	20,000 J
	29-Feb-2000	BOXP47	13,000 J	BOXP51	37,000 J			BOXP45	12,000 J
	1-Jun-2000			BOXV83	200,000 NJ	BOXV81	100,000 NJ		

Table C-24a. Additional Analytes Detected in GAC Cartridge Samples Collected from PSVE Systems on Wells 299-W18-6L, 299-W18-7, 299-W18-10L, and 299-W18-11L, October 1999 to September 2001. (3 Pages)

Volatile Organic Compound	GAC Collection Date	W18-6L		W18-7		W18-10L		W18-11L	
		HEIS Number	Result (µg/kg) ¹	HEIS Number	Result (µg/kg) ¹	HEIS Number	Result (µg/kg) ¹	HEIS Number	Result (µg/kg) ¹
Chloromethane	29-Nov-1999	B0X464	420 JB	B0X467	560 JB	B0X465	530 JB	B0X462	25,000 BJ
	28-Dec-1999	B0XB97	570 J					B0XBB0	490 J
	29-Feb-2000			B0XP51	44,000 J	B0XP44	10,000 J		
Hexachloroethane	29-Nov-1999								
Methylene Chloride	26-28-Oct-1999	B0WV21	320,000 B	B0WV18	160,000 B	B0WV17	200,000 B	B0WV23	110,000 B
	29-Nov-1999	B0X464	1,900 B	B0X467	2,800 B	B0X465	2,600 B	B0X462	89,000 B
	28-Dec-1999	B0XB97	1,300 B	B0XB95	1,100 BJ	B0XB99	3,300 B	B0XBB0	480 BJ
	29-Jan-2000	B0XH10	28,000 B	B0XH09	11,000 BJ			B0XH13	32,000 J
	29-Feb-2000	B0XP47	42,000 B	B0XP51	94,000 B	B0XP44	28,000 BJ	B0XP45	39,000 B
	1-Jun-2000	B0XV76	400,000 NJ	B0XV83	400,000 NJ	B0XV81	80,000 NJ	B0XV77	90,000 NJ
	29-Aug-2000	B104N3	3,000,000 NJ	B104N4	3,000,000 NJ	B104N5	200,000 NJ	B104N6	40,000 NJ
	26-Mar-2001	B11LB3	1,000 NJB	B11LB4	400,000 NJB	B11LB5	30,000 NJB	B11LB6	1,000 NJB
	30-May-01	B124R7	2,000,000	B124R8	18,000,000	B124R9	12,000,000	B124T0	63,000
Silane	29-Jan-2000			B0XH09	90,000 JB			B0XH13	200,000 JB
Tetrachloroethene	29-Nov-1999	B0X464	300 J	B0X467	980 J				
	28-Dec-1999	B0XB97	350 J	B0XB95	2,800				
	29-Jan-2000			B0XH09	7,600 J				
Trichloroethene	26-28-Oct-1999			B0WV18	16,000 J				
	29-Nov-1999	B0X464	420 J	B0X467	2,400				
	28-Dec-1999	B0XB97	400 J						
	29-Jan-2000			B0XH09	15,000				

Table C-24a. Additional Analytes Detected in GAC Cartridge Samples Collected from PSVE Systems on Wells 299-W18-6L, 299-W18-7, 299-W18-10L, and 299-W18-11L, October 1999 to September 2001. (3 Pages)

Volatile Organic Compound	GAC Collection Date	W18-6L		W18-7		W18-10L		W18-11L	
		HEIS Number	Result (µg/kg) ¹	HEIS Number	Result (µg/kg) ¹	HEIS Number	Result (µg/kg) ¹	HEIS Number	Result (µg/kg) ¹
Trichloroethene	29-Feb-2000								
Unknown	29-Jan-2000			BOXH09	30,000 JB				
	31-Jul-2000							B0YW28	5 J
	29-Jan-2001	B11BW8	800 JB	B11BW9	1,000 JB	B11BX0	1,000 JB	B11BX1	20,000 J
	27-Feb-2001	B11JL4	700 J						
	26-Mar-2001								

A = Blank space indicates no data collected.

B = Indicates analyte is found in the associated blank as well as in the sample.

J = Indicates an estimated value.

N = Indicates presumptive evidence of a compound. The flag is only used for tentatively identified compounds, where the identification is based on a mass spectral library search.

Table C-24b. Additional Analytes Detected in GAC Cartridge Samples Collected from PSVE Systems on Wells 299-W18-12, 299-W18-246L, 299-W18-247L, and 299-W18-252L, October 1999 to September 2001. (3 Pages)

Volatile Organic Compound	GAC Collection Date	W18-12		W18-246L		W18-247L		W18-252L	
		HEIS Number	Result (mg/kg) ¹	HEIS Number	Result (mg/kg) ¹	HEIS Number	Result (mg/kg) ¹	HEIS Number	Result (mg/kg) ¹
1,1-Difluoroethane	31-Jul-2000								y
1,1,2-Trichloro-1,2-Ethane	29-Jan-2000			BOXH08	20,000 NJ				
1,1,2,2-Tetrachloroethane	29-Feb-2000					BOXP49	8,100 J		
2-Butanone	29-Nov-1999	BOX468	550 JB	BOX463	300 JB	BOX461	360 JB	BOX466	600 JB
	29-Jan-2000			BOXH08	11,000 J				
Acetone	26-28-Oct-1999					B0WV19	52,000 JB		
	29-Nov-1999	BOX468	2,200 JB	BOX463	1,200 JB	BOX461	1,200 JB	BOX466	3,700 B
	28-Dec-1999			BOXB98	18,000 BJ	BOXBB1	450 BJ		
	29-Jan-2000	BOXH11	34,000 BJ	BOXH08	23,000 BJ	BOXH07	45,000 BJ		
	29-Feb-2000			BOXP48	100,000 BJ	BOXP49	82,000		
Bromodichloromethane	28-Dec-1999								
Bromofluorobenzene	29-Jan-2000								
Chloroform	26-28-Oct-1999			B0WV20	38,000 J	B0WV19	15,000 J		
	29-Nov-1999	BOX468	5,800	BOX463	4,600	BOX461	6,900	BOX466	11,000
	28-Dec-1999	BOXB94	2,000			BOXBB1	4,400	BOXB96	7,200
	29-Jan-2000	BOXH11	31,000 J	BOXH08	11,000 J	BOXH07	51,000 J	BOXH12	30,000 J
	29-Feb-2000	BOXP46	9,700 J	BOXP48	18,000 J	BOXP49	8,800 J	BOXP50	11,000 J
	1-Jun-2000	BOXV79	300,000 NJ						
Chloromethane	29-Nov-1999	BOX468	440 JB	BOX463	560 JB	BOX461	410 JB		

Table C-24b. Additional Analytes Detected in GAC Cartridge Samples Collected from PSVE Systems on Wells 299-W18-12, 299-W18-246L, 299-W18-247L, and 299-W18-252L, October 1999 to September 2001. (3 Pages)

Volatile Organic Compound	GAC Collection Date	W18-12		W18-246L		W18-247L		W18-252L	
		HEIS Number	Result (mg/kg) ¹	HEIS Number	Result (mg/kg) ¹	HEIS Number	Result (mg/kg) ¹	HEIS Number	Result (mg/kg) ¹
Hexachloroethane	28-Dec-1999					B0XB96	430 J	B0XB96	350 J
	29-Feb-2000								
	29-Nov-1999							B0X466	2,000 NJ
Methylene Chloride	26-28-Oct-1999			B0WV20	170,000 B	B0WV19	100,000 B	B0WV22	170,000 B
	29-Nov-1999	B0X468	2,800 B	B0X463	2,500 B	B0X461	2,200 B	B0X466	2,700 B
	28-Dec-1999	B0XB94	520 BJ	B0XB98	37,000 B	B0XB96	1,000 B	B0XB96	820 BJ
	29-Jan-2000	B0XH11	37,000 B	B0XH08	12,000 BJ	B0XH07	29,000 BJ	B0XH12	34,000 B
	29-Feb-2000	B0XP46	33,000 B	B0XP48	34,000 BJ	B0XP49	40,000 B	B0XP50	33,000 B
	1-Jun-2000	B0XV79	300,000 NJ	B0XV82	2,000,000 NJ	B0XV78	80,000 NJ	B0XV84	400,000 NJ
	29-Aug-2000	B104N7	2,000,000 NJ	B104N8	2,000,000 NJ	B104N9	40,000 NJ	B104P0	2,000,000 NJ
	26-Mar-2001	B11LB7	100,000 NJB	B11LB8	300,000 NJB	B11LB9	1,000 NJB	B11LC0	70,000 NJB
	30-May-01	B124T1	23,000,000	B124T2	8,200,000	B124T3	2,700,000	B124T4	7,100,000
Silane	29-Jan-2000	B0XH11	200,000 JB	B0XH08	90,000 JB			B0XH12	200,000 JB
Tetrachloroethene	29-Nov-1999	B0X468	430 J	B0X463	1,100 J			B0X466	3,700
	28-Dec-1999	B0XB94	320 J					B0XB96	440 J
	29-Jan-2000			B0XH08	2,300 J				
Trichloroethene	26-28-Oct-1999								
	29-Nov-1999	B0X468	510 J	B0X463	730 J			B0X466	2,700
	28-Dec-1999	B0XB94	400 J					B0XB96	530 J
	29-Jan-2000			B0XH08	2,400 J				
	29-Feb-2000			B0XP48	11,000 J				

Table C-24b. Additional Analytes Detected in GAC Cartridge Samples Collected from PSVE Systems on Wells 299-W18-12, 299-W18-246L, 299-W18-247L, and 299-W18-252L, October 1999 to September 2001. (3 Pages)

Volatile Organic Compound	GAC Collection Date	W18-12		W18-246L		W18-247L		W18-252L	
		HEIS Number	Result (mg/kg) ¹	HEIS Number	Result (mg/kg) ¹	HEIS Number	Result (mg/kg) ¹	HEIS Number	Result (mg/kg) ¹
Unknown	29-Jan-2000	B0XH11	40,000 JB	B0XH08	20,000 JB	B0XV78	100,000 J		
	31-Jul-2000								
	29-Jan-2001	B11BX2	2,000 JB	B11BX3	100,000 J			B11BX5	90,000 J
	27-Feb-2001								
	26-Mar-2001	B11LB7	100,000 J						

A = Blank space indicates no data collected.

B = Indicates analyte is found in the associated blank as well as in the sample.

J = Indicates an estimated value.

N = Indicates presumptive evidence of a compound. The flag is only used for tentatively identified compounds, where the identification is based on a mass spectral library search.

**Table C-25. Volume of Water Drained from GAC Cartridges and Hoses
During Sample Collection at the PSVE Systems.**

Well No.	12/28/99 Volume from Hoses (L)	12/28/1999 Volume from GAC (L)	1/13/2000 Volume from Hoses (L)	1/27/2000 Volume from GAC (L)	2/29/2000 Volume from GAC (L)	3/23/00 Volume from Hoses (L)
W18-6L			3.79			1.89
W18-7	0.30		0.47		0.02	0.95
W18-10L		0.03	1.89	0.30	1.00	0.12
W18-11L			dry			dry
W18-12			0.47	0.19	0.06	0.47
W18-246L	0.59		0.95			0.24
W18-247L			0.95			0.95
W18-252L	0.18		0.95			0.95
Total	1.06	0.03	9.46	0.49	1.08	5.56

Table C-26. Passive Soil Vapor Extraction Well Network. (3 Pages)

Well/Probe	Purpose	Instrumentation			Comment	Open Interval (m bgs)
		Datalogger	Parameter	Instrument		
299-W18-6L	Passive extraction	Datalogger	Differential Pressure	Ashcroft +/- 2.5 kPa (10 in. w.c.)	Two 60-m lengths of sample tubing dropped in well	57.9 – 61.3 (190 – 201 ft)
			Airflow	Sierra 0 to 76 m/min (0 to 250 ft/min)		
			Temperatures at 3 m, 61 m (10 ft, 200 ft) below top of well	Type K thermocouple wire		
			CC14	B&K		
			CC14	GAC		
299-W18-6U	Monitoring	Datalogger	Valve	Baroball	Sealed well	28.8 – 37.9 (94.5 – 124.5 ft)
			Differential Pressure	Ashcroft +/- 6.2 kPa (25 in. w.c.)		
299-W18-7	Passive extraction	None	CC14	GAC		51.4 – 61.9 (168.5 – 203 ft)
			Valve	Baroball		

Table C-26. Passive Soil Vapor Extraction Well Network. (3 Pages)

Well/Probe	Purpose	Instrumentation			Comment	Open Interval (m bgs)
		Datalogger	Parameter	Instrument		
299-W18-9	Monitoring	Datalogger	Differential pressure	Ashcroft +/- 2.5 kPa (10 in. w.c.)	Sealed well	54.9 – 64.5 (180 – 211.5 ft)
			Temperatures at 3 m, 61 m (10 ft, 200 ft) below top of well	Type K thermocouple wire		
299-W18-10L	Passive extraction	None	CCl4	GAC		44.8 – 64.3 (147 – 211 ft)
			Valve	Baroball		
299-W18-11L	Passive extraction	None	CCl4	GAC		54.9 – 64.9 (180 – 213 ft)
			Valve	Baroball		
299-W18-12	Passive extraction	None	CCl4	GAC		54.1 – 64.9 (177.5 – 213 ft)
			Valve	Baroball		
299-W18-246L	Passive extraction	None	CCl4	GAC		50.3 – 53.3 (165 – 175 ft)
			Valve	INEL valve		
299-W18-247L	Passive extraction	Datalogger	Differential pressure	Ashcroft +/- 2.5 kPa (10 in. w.c.)	Well with long passive extraction record	49.4 – 52.4 (162 – 172 ft)
			Airflow	Sierra 0 to 76 m/min (0 to 250 ft/min)		
			Temperatures at 3 m, 61 m (10 ft, 200 ft) below top of well	Type K thermocouple wire		
			CCl4	B&K		
			CCl4	GAC		
			Valve	Baroball		

Table C-26. Passive Soil Vapor Extraction Well Network. (3 Pages)

Well/Probe	Purpose	Instrumentation			Comment	Open Interval (m bgs)
		Datalogger	Parameter	Instrument		
299-W18-247U	Monitoring	Datalogger	Differential pressure	Ashcroft +/- 6.2 kPa (25 in. w.c.)	Sealed well	36.3 - 39.3 (119 - 129 ft)
299-W18-252L	Passive extraction	Datalogger	Differential pressure	Ashcroft +/- 2.5 kPa (10 in. w.c.)		50.3 - 56.4 (165 - 185 ft)
			Airflow	Sierra 0 to 76 m/min (0 to 250 ft/min)		
			Temperatures at 3 m, 61 m (10 ft, 200 ft) below top of well	Type K thermocouple wire		
			Barometric pressure	Setra		
			CCI4	B&K		
			CCI4	GAC		
			Valve	Baroball		
299-W18-252U	Monitoring	Datalogger	Differential pressure	Ashcroft +/- 2.5 kPa (10 in. w.c.)	Sealed well	34.4 - 40.5 (113 - 133 ft)
299-W18-252/SST100 (red)	Monitoring	Datalogger	Differential pressure	Ashcroft +/- 1.2 kPa (5 in. w.c.)	Stainless steel tubes strapped to outside of casing; color refers to banding on individual tubes	30.5 (100 ft)
299-W18-252/SST145 (blue)	Monitoring	Datalogger	Differential pressure	Ashcroft +/- 2.5 kPa (10 in. w.c.)		44.2 (145 ft)
299-W18-252/SST210 (yellow)	Monitoring	Datalogger	Differential pressure	Ashcroft +/- 2.5 kPa (10 in. w.c.)		64.0 (210 ft)
CPT-4F/10 (black)	Monitoring	Datalogger	Differential pressure	JYC - 0.25 to + 0.25 kPa (-1 to +1 in. w.c.)	Soil probes emplaced using cone penetrometer; color refers to banding on the individual tubes	3 (10 ft)
CPT-4F/25 (white)	Monitoring	Datalogger	Differential pressure	JYC - 0.25 to + 0.25 kPa (-1 to +1 in. w.c.)		7.6 (25 ft)
CPT-4F/50 (blue)	Monitoring	Datalogger	Differential pressure	JYC - 0.25 to + 0.25 kPa (-1 to +1 in. w.c.)		15.2 (50 ft)
CPT-4F/75 (yellow)	Monitoring	Datalogger	Differential pressure	Ashcroft +/- 6.2 kPa (25 in. w.c.)		22.9 (75 ft)
CPT-4F/109 (red)	Monitoring	Datalogger	Differential pressure	Ashcroft +/- 1.2 kPa (5 in. w.c.)		33.2 (109 ft)

**Table C-27. Concentrations of Contaminants Measured During Passive Soil Vapor Extraction,
October 1999 through April 2001.**

Well	Carbon Tetrachloride Concentration (ppmv)		Chloroform Concentration (ppmv)		Methylene Chloride Concentration (ppmv)		Methyl Ethyl Ketone Concentration (ppmv)		Water Concentration (ppmv)		
	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum	Minimum	Average
W18-6L	69.2	19.1	24.0	0.6	50.0	4.8	10.3	1.0	70,100	2,990	13,829
W18-247L	13.7	1.0	10.2	1.8	21.3	3.2	5.7	0.7	38,500	3,140	11,906
W18-252L	45.5	17.9	9.3	0.6	20.2	1.4	10.3	0.2	48,400	3,090	12,388

Table C-28. Differential Pressures and Flowrates Measured During Passive Soil Vapor Extraction, October 1999 through April 2001.

Well/Probe	Differential Pressure Maximum Positive (kPa)	Differential Pressure Minimum Negative (kPa)	Differential Pressure Average Positive (kPa)	Differential Pressure Average Negative (kPa)	Flowrate Maximum (m ³ /min)	Flowrate Average of All Recorded Flows (m ³ /min)	FY 00 Flowrate Average of Flows Above Threshold ^a (m ³ /min)	FY 01 Flowrate Average of Flows Above Threshold ^b (m ³ /min)
W18-6L	1.30	-1.90	0.29	-0.33	0.38	0.02	0.11	0.15
W18-6U	0.72	-0.86	0.11	-0.11				
W18-247L	1.35	-1.87	0.32	-0.34	0.24	0.01	0.11	0.15
W18-247U	N/A	N/A	N/A	N/A				
W18-252L	0.98	-1.44	0.19	-0.23	0.29	0.02	0.11	0.08
W18-252U	0.78	-0.92	0.14	-0.13				
W18-9	0.68	-0.69	0.09	-0.11				
W18-252SST100	0.77	-0.89	0.13	-0.12				
W18-252SST145	1.29	-1.80	0.33	-0.33				
W18-252SST210	1.28	-1.77	0.32	-0.32				
CPT-4F/ 10	0.04	-0.06	0.00	-0.01				
CPT-4F/ 25	0.08	-0.07	0.01	-0.01				
CPT-4F/ 50	0.16	-0.13	0.03	-0.02				
CPT-4F/ 75	0.24	-0.78	0.06	-0.24				
CPT-4F/ 109	0.68	-0.89	0.11	-0.13				

^a Threshold flows are as follows for FY 00: W18-6L = 0.03 m³/min; W18-247L = 0.05 m³/min; W18-252L = 0.04 m³/min.

^b Threshold flows are as follows for FY 01: W18-6L = 0.04 m³/min; W18-247L = 0.09 m³/min; W18-252L = 0.02 m³/min.

N/A = Data suspect

APPENDIX D

FISCAL YEAR 1998 SOIL VAPOR MONITORING DATA

Table D-1. Carbon Tetrachloride Concentrations Monitored at the 216-Z-1A/Z-18/Z-12 Wellfield During Nonoperation of the SVE System, October 1997 Through September 1998. (6 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date Time	Differential Pressure (kPa)	CCl ₄ (ppmv)	CHCl ₃ (ppmv)	MEK (ppmv)	CH ₂ Cl ₂ (ppmv)	Water (ppmv)	Comment
79-01/ 5 ft	2	1	8/14/98	--	--	--	--	--	--	Destroyed or not found
79-03/ 5 ft	2	1	9/29/98 8:00	0.000	0.0	0.0	0.0	0.0	11,000	Substituted for 79-01
79-11/ 5 ft	2	1	12/1/97 13:55	-0.010	0.0	0.0	0.0	0.0	8,280	
79-11/ 5 ft	2	1	1/10/98 12:08	-0.010	0.0	0.0	0.0	0.0	4,860	
79-11/ 5 ft	2	1	1/29/98 10:16	-0.007	0.0	0.0	0.0	0.0	8,170	
79-11/ 5 ft	2	1	2/26/98 11:44	-0.002	0.0	0.0	0.0	0.0	7,120	
79-11/ 5 ft	2	1	3/24/98 8:06	-0.002	0.0	0.0	0.0	0.0	9,050	
79-11/ 5 ft	2	1	8/14/98 10:47	0.017	0.0	0.0	0.0	0.0	9,830	Analyzed on 8/15/98
79-11/ 5 ft	2	1	9/29/98 10:53	0.005	0.0	0.0	0.0	0.0	16,600	
87-01R/ 5 ft	2	1	12/1/97 13:18	-0.007	0.0	0.0	0.0	0.0	8,430	
87-01R/ 5 ft	2	1	1/10/98 14:40	-0.012	0.0	0.0	0.0	0.0	5,050	
87-01R/ 5 ft	2	1	1/29/98 11:46	-0.005	0.0	0.0	0.0	0.0	8,380	
87-01R/ 5 ft	2	1	2/26/98 13:01	-0.032	0.0	5.0	1.4	0.0	6,940	
87-01R/ 5 ft	2	1	3/24/98 10:23	0.000	0.0	0.0	0.0	0.0	9,540	
87-01R/ 5 ft	2	1	8/14/98 7:34	0.002	0.0	1.1	0.0	0.0	9,780	Partially destroyed, analyzed on 8/15/98
87-03/ 5 ft	2	1	9/29/98 10:03	0.002	0.0	0.0	0.0	0.0	13,300	Substituted for 87-01R
87-05/ 5 ft	2	1	8/14/98 10:04	0.010	0.0	1.0	0.0	0.0	9,750	Analyzed on 8/15/98
87-05/ 5 ft	2	1	9/29/98 10:09	0.002	0.0	0.0	0.0	0.0	12,700	
87-09/ 5 ft	2	1	12/1/97 13:44	-0.085	0.0	0.0	0.0	0.0	8,120	
87-09/ 5 ft	2	1	1/10/98 12:00	-0.010	0.0	0.0	0.0	0.0	4,700	
87-09/ 5 ft	2	1	1/29/98 10:00	-0.010	0.0	0.0	0.0	0.0	7,840	
87-09/ 5 ft	2	1	2/26/98 11:17	-0.007	0.0	0.0	0.0	0.0	6,360	

Table D-1. Carbon Tetrachloride Concentrations Monitored at the 216-Z-1A/Z-18/Z-12 Wellfield During Nonoperation of the SVE System, October 1997 Through September 1998. (6 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date Time	Differential Pressure (kPa)	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment
87-09/ 5 ft	2	1	3/24/98 7:53	-0.002	0.0	0.0	0.0	0.0	8,970	
87-09/ 5 ft	2	1	8/14/98 11:27	0.017	0.0	0.0	0.0	0.0	9,770	Analyzed on 8/15/98
87-09/ 5 ft	2	1	9/29/98 11:17	0.007	1.5	0.0	0.0	0.0	18,800	
N-5/ 5 ft	2	1	2/5/98 8:15	-0.127	--	--	--	--	--	Substitute for N-6; sample tube clogged
N-5/ 5 ft	2	1	2/26/98	-0.002	--	--	--	--	--	Substitute for N-6; could not pull a sample
N-6/ 5 ft	2	1	12/1/97 14:20	-0.102	0.0	0.0	0.0	0.0	8,520	
N-6/ 5 ft	2	1	1/10/98 12:22	-0.010	--	--	--	--	--	Sample tube clogged
N-6/ 5 ft	2	1	1/29/98	-0.017	--	--	--	--	--	Unable to sample
N-6/ 5 ft	2	1	3/24/98 12:25	0.017	0.0	0.0	1.1	0.0	13,800	
CPT-13A/ 9 ft	3	2	12/1/97 14:00	-0.007	0.0	0.0	0.0	0.0	8,270	
CPT-13A/ 9 ft	3	2	1/10/98 12:15	-0.010	0.0	0.0	0.0	0.0	4,940	
CPT-13A/ 9 ft	3	2	1/29/98 10:23	-0.012	0.0	0.0	0.0	0.0	8,260	
CPT-13A/ 9 ft	3	2	2/26/98 11:36	-0.002	0.0	0.0	0.0	0.0	7,000	
CPT-13A/ 9 ft	3	2	3/24/98 12:15	0.007	0.0	0.0	1.4	0.0	11,100	
CPT-13A/ 9 ft	3	2	4/30/98 7:41	-0.010	0.0	0.0	1.1	0.0	8,980	
CPT-13A/ 9 ft	3	2	5/26/98 6:47	0.005	0.0	0.0	0.0	0.0	8,070	
CPT-13A/ 9 ft	3	2	6/29/98 7:16	-0.007	0.0	3.3	0.0	0.0	13,500	
CPT-13A/ 9 ft	3	2	8/14/98 10:55	0.017	0.0	0.0	0.0	0.0	9,810	Analyzed on 8/15/98
CPT-13A/ 9 ft	3	2	9/29/98 10:59	0.007	0.0	0.0	0.0	0.0	17,100	
CPT-31/ 25 ft	8	2	12/1/97 14:54	-0.022	0.0	0.0	0.0	0.0	7,900	
CPT-31/ 25 ft	8	2	1/10/98 14:20	-0.100	0.0	0.0	0.0	0.0	4,980	
CPT-31/ 25 ft	8	2	1/29/98 11:22	0.000	0.0	0.0	0.0	0.0	8,760	

Table D-1. Carbon Tetrachloride Concentrations Monitored at the 216-Z-1A/Z-18/Z-12 Wellfield During Nonoperation of the SVE System, October 1997 Through September 1998. (6 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date Time	Differential Pressure (kPa)	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment
CPT-31/ 25 ft	8	2	2/26/98 12:51	-0.007	0.0	0.0	0.0	0.0	7,030	
CPT-31/ 25 ft	8	2	3/24/98 10:00	-0.002	0.0	0.0	0.0	0.0	9,480	
CPT-31/ 25 ft	8	2	8/14/98 8:51	0.007	0.0	0.0	0.0	0.0	9800	Analyzed on 8/15/98
CPT-31/ 25 ft	8	2	9/29/98 9:23	-0.010	0.0	0.0	0.0	0.0	12,300	
CPT-32/ 25 ft	8	2	12/1/97 14:26	-0.007	0.0	0.0	0.0	0.0	8,220	
CPT-32/ 25 ft	8	2	1/10/98 14:30	-0.010	0.0	0.0	0.0	0.0	5,430	
CPT-32/ 25 ft	8	2	1/29/98 11:15	-0.010	5.1	0.0	0.0	0.0	8,640	
CPT-32/ 25 ft	8	2	2/26/98 12:44	-0.007	6.6	0.0	0.0	0.0	6,950	
CPT-32/ 25 ft	8	2	3/24/98 10:06	-0.010	9.1	0.0	0.0	1.1	9,630	
CPT-32/ 25 ft	8	2	8/14/98 10:16	0.012	0.0	1.2	1.2	0.0	9850	Analyzed on 8/15/98
CPT-32/ 25 ft	8	2	9/29/98 10:14	0.000	0.0	0.0	0.0	0.0	15,000	
CPT-7A/ 32 ft	10	2	12/1/97 14:42	-0.010	0.0	0.0	0.0	0.0	8,050	
CPT-7A/ 32 ft	10	2	1/10/98 14:50	-0.010	0.0	0.0	0.0	0.0	5,590	
CPT-7A/ 32 ft	10	2	1/29/98 9:53	-0.012	1.9	0.0	0.0	0.0	7,830	
CPT-7A/ 32 ft	10	2	2/26/98 11:02	-0.002	2.3	0.0	0.0	0.0	6,390	
CPT-7A/ 32 ft	10	2	3/24/98 7:46	-0.007	2.2	0.0	0.0	0.0	9,070	
CPT-7A/ 32 ft	10	2	8/14/98 11:46	0.032	1.4	1.0	0.0	0.0	9,720	Analyzed on 8/15/98
CPT-7A/ 32 ft	10	2	9/29/98 11:22	-0.005	1.7	0.0	0.0	0.0	17,000	
CPT-1A/ 35 ft	11	2	12/1/97 15:13	-0.012	0.0	0.0	0.0	0.0	8,190	
CPT-1A/ 35 ft	11	2	1/10/98 14:35	-0.012	0.0	0.0	0.0	0.0	5,500	
CPT-1A/ 35 ft	11	2	1/29/98 11:40	0.000	0.0	0.0	0.0	0.0	8,010	
CPT-1A/ 35 ft	11	2	2/26/98 13:08	-0.002	0.0	0.0	0.0	0.0	6,530	
CPT-1A/ 35 ft	11	2	3/24/98 10:18	0.000	1.2	0.0	0.0	0.0	9,220	
CPT-1A/ 35 ft	11	2	4/30/98 7:35	-0.017	1.2	0.0	0.0	0.0	8,760	

Table D-1. Carbon Tetrachloride Concentrations Monitored at the 216-Z-1A/Z-18/Z-12 Wellfield During Nonoperation of the SVE System, October 1997 Through September 1998. (6 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date Time	Differential Pressure (kPa)	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment
CPT-1A/ 35 ft	11	2	5/26/98 6:40	0.002	1.3	0.0	0.0	0.0	7,970	
CPT-1A/ 35 ft	11	2	6/29/98 7:10	-0.020	0.0	3.5	0.0	0.0	13,100	
CPT-1A/ 35 ft	11	2	8/14/98 7:55	0.005	1.4	0.0	0.0	0.0	9,750	Analyzed on 8/15/98
CPT-1A/ 35 ft	11	2	9/29/98 7:53	-0.012	1.1	0.0	0.0	0.0	10,700	
CPT-33/ 40 ft	12	2	12/1/97 15:00	-0.017	0.0	0.0	0.0	0.0	7,960	
CPT-33/ 40 ft	12	2	1/10/98 14:04	-0.017	1.8	0.0	0.0	0.0	5,390	
CPT-33/ 40 ft	12	2	1/29/98 11:32	-0.007	1.8	0.0	0.0	0.0	8,230	
CPT-33/ 40 ft	12	2	2/26/98 12:57	-0.002	1.3	0.0	0.0	0.0	6,870	
CPT-33/ 40 ft	12	2	3/24/98 9:35	0.002	1.4	0.0	0.0	0.0	9,320	
CPT-33/ 40 ft	12	2	8/14/98 8:40	0.007	1.1	0.0	0.0	0.0	9,810	Analyzed on 8/15/98
CPT-33/ 40 ft	12	2	9/29/98 9:15	-0.012	2.0	0.0	0.0	0.0	12,100	
CPT-34/ 86 ft	26	2	8/14/98 8:12	0.000	4.5	2.1	1.3	0.0	9,800	Analyzed on 8/15/98
CPT-34/ 86 ft	26	2	9/29/98 8:11	-0.075	5.9	0.0	0.0	0.0	10,900	
CPT-4A/ 91 ft	28	2	8/14/98 9:53	0.050	6.9	0.0	1.1	6.5	9,770	Analyzed on 8/15/98
CPT-4A/ 91 ft	28	2	9/29/98 9:55	-0.105	7.7	0.0	0.0	5.5	13,000	
W18-252SST/ 100 ft	30	2	8/14/98 9:18	0.040	8.9	0.0	0.0	0.0	9,640	Analyzed on 8/15/98
W18-252SST/ 100 ft	30	2	9/29/98 9:31	-0.112	17.8	0.0	0.0	0.0	11,400	
W18-152/ 101 ft	31	2	8/14/98 7:44	0.005	11.1	1.4	0.0	0.0	9,670	Analyzed on 8/15/98
W18-152/ 101 ft	31	2	9/29/98 7:43	-0.072	0.0	0.0	0.0	0.0	10,600	
W18-167/ 106 ft	32	3	8/14/98	--	--	--	--	--	--	No access
W18-167/ 106 ft	32	3	9/29/98 8:56	-0.082	79.7	1.6	0.0	3.2	11,200	

Table D-1. Carbon Tetrachloride Concentrations Monitored at the 216-Z-1A/Z-18/Z-12 Wellfield During Nonoperation of the SVE System, October 1997 Through September 1998. (6 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date Time	Differential Pressure (kPa)	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment
CPT-4F/ 109 ft	33	2	8/14/98 9:41	0.040	6.3	2.6	1.0	1.2	9,790	Analyzed on 8/15/98
CPT-4F/ 109 ft	33	2	9/29/98 9:43	-0.070	13.8	0.0	0.0	0.0	12,500	
W18-174/ 117 ft	36	3	8/14/98	--	--	--	--	--	--	Not in service
W18-174/ 117 ft	36	3	9/29/98	--	--	--	--	--	--	Not in service
W18-158L/ 120 ft	36	3	8/14/98	--	--	--	--	--	--	No access
W18-158L/ 120 ft	36	3	9/29/98 8:47	-0.082	143.0	0.0	7.7	165.0	11,100	
W18-249/ 130 ft	39	3	8/14/98	--	--	--	--	--	--	Not in service
W18-249/ 130 ft	39	3	9/29/98 8:33	-0.095	20.4	2.0	1.1	4.8	10,900	
W18-248/ 131 ft	40	3	8/14/98 11:20	0.072	7.1	2.2	0.0	0.0	9,810	Analyzed on 8/15/98
W18-248/ 131 ft	40	3	9/29/98 11:12	-0.075	86.3	2.3	0.0	1.5	14,300	
W18-7/ 197 ft	60	6	12/1/97	--	--	--	--	--	--	Not in service
W18-7/ 197 ft	60	6	1/10/98 14:45	0.095	12.6	0.0	0.0	0.0	6,180	
W18-7/ 197 ft	60	6	1/29/98 10:09	0.767	14.4	0.0	0.0	0.0	8,130	
W18-7/ 197 ft	60	6	2/26/98 11:25	-0.516	15.7	0.0	0.0	1.5	6,580	
W18-7/ 197 ft	60	6	2/26/98 11:25	-0.516	15.7	0.0	0.0	1.5	6,550	Duplicate
W18-7/ 197 ft	60	6	3/24/98 7:59	0.144	15.8	0.0	0.0	1.5	9,020	
W18-7/ 197 ft	60	6	8/14/98 11:09	0.035	0.0	2.3	1.2	0.0	9,710	Analyzed on 8/15/98
W18-7/ 197 ft	60	6	9/29/98 11:06	-0.192	17.3	0.0	0.0	0.0	14,500	
W18-7/ 197 ft	60	6	9/29/98 11:06	-0.192	17.2	1.2	0.0	0.0	14,400	Duplicate
W18-12/ 198 ft	60	6	8/14/98 12:50	0.391	1.2	2.3	1.0	2.0	9,730	Analyzed on 8/15/98
W18-12/ 198 ft	60	6	9/29/98 10:31	-0.214	3.8	0.0	0.0	9.0	12,200	
W18-6L/ 208 ft	63	6	12/1/97	--	--	--	--	--	--	Not in service
W18-6L/ 208 ft	63	6	1/10/98 13:50	0.139	24.0	0.0	0.0	2.0	4,700	

Table D-1. Carbon Tetrachloride Concentrations Monitored at the 216-Z-1A/Z-18/Z-12 Wellfield During Nonoperation of the SVE System, October 1997 Through September 1998. (6 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date Time	Differential Pressure (kPa)	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment
W18-6L/ 208 ft	63	6	1/29/98 11:05	0.687	25.8	0.0	0.0	1.9	8,350	
W18-6L/ 208 ft	63	6	2/26/98 12:30	-0.456	31.3	1.0	0.0	1.2	6,830	
W18-6L/ 208 ft	63	6	3/24/98 10:11	0.167	0.0	3.1	2.3	1.6	9,850	Sampling tube removed, SVE wellhead adapter installed prior to sampling; sampled from wellhead after well had been open to atmosphere for wellhead assembly changeout.
W18-6L/ 208 ft	63	6	8/14/98 10:36	0.252	4.3	1.6	0.0	0.0	9,560	Analyzed on 8/15/98
W18-6L/ 208 ft	63	6	8/14/98 10:36	0.252	4.2	1.6	0.0	0.0	9,560	Duplicate; analyzed on 8/15/98
W18-6L/ 208 ft	63	6	9/29/98 10:21	-0.214	14.5	1.0	0.0	2.2	12,600	

Note: Concentrations recorded in this table as 0.0 ppmv were measured as <1.0 ppmv.

-- = no data

bgs = below ground surface

CCl4 = carbon tetrachloride

CH2Cl2 = methylene chloride

CHCl3 = chloroform

MEK = methylethyl ketone

ppmv = parts per million by volume

Table D-2. Carbon Tetrachloride Concentrations Monitored at the 216-Z-9 Wellfield During Nonoperation of the SVE System, October 1997 Through September 1998. (8 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date Time	Differential Pressure (kPa)	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment
86-06/ 5 ft	2	1	12/1/97 12:07	-0.005	0.0	0.0	0.0	0.0	7,340	
86-06/ 5 ft	2	1	1/10/98 9:08	-0.010	0.0	0.0	0.0	0.0	4,150	
86-06/ 5 ft	2	1	1/29/98 8:20	0.005	0.0	0.0	0.0	0.0	7,300	
86-06/ 5 ft	2	1	2/26/98 8:42	-0.010	0.0	0.0	0.0	0.0	5,460	
86-06/ 5 ft	2	1	3/24/98 13:00	0.007	0.0	0.0	0.0	0.0	11,000	
86-06/ 5 ft	2	1	4/30/98 11:06	0.002	0.0	0.0	0.0	0.0	13,100	
86-06/ 5 ft	2	1	5/26/98 9:10	0.005	0.0	0.0	0.0	0.0	8,410	
86-06/ 5 ft	2	1	6/29/98 11:42	0.010	0.0	0.0	0.0	1.6	23,800	
94-09/ 5 ft	2	1	12/1/97 12:35	-0.007	1.3	0.0	0.0	0.0	7,460	
94-09/ 5 ft	2	1	1/10/98 9:22	-0.012	0.0	0.0	0.0	0.0	4,110	
94-09/ 5 ft	2	1	1/29/98 8:40	-0.007	0.0	0.0	0.0	0.0	7,340	
94-09/ 5 ft	2	1	2/26/98 9:02	-0.007	1.3	0.0	0.0	0.0	5,720	
94-09/ 5 ft	2	1	3/24/98 11:51	0.002	0.0	0.0	0.0	0.0	10,600	
94-09/ 5 ft	2	1	4/30/98 11:12	0.007	0.0	0.0	0.0	0.0	13,500	
94-09/ 5 ft	2	1	5/26/98 9:17	-0.002	0.0	0.0	0.0	0.0	8,510	
94-09/ 5 ft	2	1	6/29/98 9:23	0.007	0.0	2.2	0.0	0.0	20,000	
94-09/ 5 ft	2	1	8/14/98 12:08	0.017	0.0	1.3	0.0	0.0	9,750	Analyzed on 8/15/98
94-09/ 5 ft	2	1	9/29/98 11:35	0.007	0.0	1.5	0.0	0.0	21,200	
95-11/ 5 ft	2	1	12/1/97 12:57	-0.007	0.0	0.0	0.0	0.0	7,730	
95-11/ 5 ft	2	1	1/10/98 10:07	-0.010	0.0	0.0	0.0	0.0	4,140	
95-11/ 5 ft	2	1	1/29/98 9:08	0.000	0.0	0.0	0.0	0.0	7,360	
95-11/ 5 ft	2	1	2/26/98 10:22	-0.005	0.0	0.0	0.0	0.0	6,040	

Table D-2. Carbon Tetrachloride Concentrations Monitored at the 216-Z-9 Wellfield During Nonoperation of the SVE System, October 1997 Through September 1998. (8 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date Time	Differential Pressure (kPa)	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment
95-11/ 5 ft	2	1	3/24/98 11:27	0.000	1.2	0.0	0.0	0.0	10,000	
95-11/ 5 ft	2	1	4/30/98 9:09	0.005	0.0	0.0	0.0	0.0	9,710	
95-11/ 5 ft	2	1	5/26/98 7:36	0.002	2.1	0.0	0.0	0.0	8,440	
95-11/ 5 ft	2	1	6/29/98 7:59	0.005	1.8	1.4	0.0	0.0	15,300	
95-12/ 5 ft	2	1	12/1/97 13:10	-0.007	0.0	0.0	0.0	0.0	7,600	
95-12/ 5 ft	2	1	1/10/98 11:25	-0.010	0.0	0.0	0.0	0.0	4,390	
95-12/ 5 ft	2	1	1/29/98 9:17	-0.010	0.0	0.0	0.0	0.0	7,380	
95-12/ 5 ft	2	1	2/26/98 10:27	-0.005	0.0	0.0	0.0	0.0	6,030	
95-12/ 5 ft	2	1	3/24/98 11:16	0.000	0.0	0.0	0.0	1.3	9,880	
95-12/ 5 ft	2	1	4/30/98 8:25	0.002	1.4	0.0	0.0	1.3	9,240	
95-12/ 5 ft	2	1	5/26/98 7:20	-0.042	1.5	0.0	0.0	0.0	8,400	
95-12/ 5 ft	2	1	6/29/98 7:45	0.000	1.2	2.2	0.0	0.0	16,000	
CPT-16/ 10 ft	3	2	12/1/97 12:50	-0.100	0.0	0.0	0.0	0.0	7,980	
CPT-16/ 10 ft	3	2	1/10/98 9:32	-0.020	0.0	0.0	0.0	0.0	4,200	
CPT-16/ 10 ft	3	2	1/29/98 8:46	-0.012	0.0	0.0	0.0	0.0	7,300	
CPT-16/ 10 ft	3	2	2/26/98 9:09	-0.017	0.0	0.0	0.0	0.0	5,770	
CPT-16/ 10 ft	3	2	3/24/98 11:46	0.012	0.0	0.0	0.0	0.0	11,100	
CPT-16/ 10 ft	3	2	4/30/98 10:41	0.002	0.0	0.0	0.0	0.0	12,700	
CPT-16/ 10 ft	3	2	5/26/98 8:40	0.007	0.0	0.0	0.0	0.0	8,340	
CPT-16/ 10 ft	3	2	6/29/98 9:11	0.002	0.0	0.0	0.0	0.0	16,400	
CPT-17/ 10 ft	3	2	12/1/97 13:17	-0.005	0.0	0.0	0.0	0.0	7,750	
CPT-17/ 10 ft	3	2	1/10/98 11:32	-0.010	0.0	0.0	0.0	0.0	4,500	
CPT-17/ 10 ft	3	2	1/29/98 9:22	-0.020	0.0	0.0	0.0	0.0	7,660	

Table D-2. Carbon Tetrachloride Concentrations Monitored at the 216-Z-9 Wellfield During Nonoperation of the SVE System, October 1997 Through September 1998. (8 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date Time	Differential Pressure (kPa)	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment
CPT-17/ 10 ft	3	2	2/26/98 10:33	-0.002	0.0	0.0	0.0	1.4	6,430	
CPT-17/ 10 ft	3	2	3/24/98 11:13	0.005	1.2	0.0	0.0	1.5	10,400	
CPT-17/ 10 ft	3	2	4/30/98 8:21	0.002	3.6	0.0	0.0	1.8	9,170	
CPT-17/ 10 ft	3	2	5/26/98 7:17	0.005	4.2	1.1	0.0	0.0	8,320	
CPT-17/ 10 ft	3	2	6/29/98 7:41	-0.002	4.1	1.0	0.0	0.0	14,900	
CPT-18/ 15 ft	5	2	12/1/97 13:04	-0.007	0.0	0.0	0.0	0.0	7,830	
CPT-18/ 15 ft	5	2	1/10/98 10:30	-0.010	0.0	0.0	0.0	0.0	4,320	
CPT-18/ 15 ft	5	2	1/29/98 9:03	0.002	0.0	0.0	0.0	0.0	7,510	
CPT-18/ 15 ft	5	2	2/26/98 10:18	-0.007	0.0	0.0	0.0	0.0	5,890	
CPT-18/ 15 ft	5	2	3/24/98 11:30	0.005	0.0	0.0	0.0	0.0	10,600	
CPT-18/ 15 ft	5	2	4/30/98 9:06	0.005	1.0	0.0	0.0	0.0	9,470	
CPT-18/ 15 ft	5	2	5/26/98 7:31	0.012	4.3	0.0	0.0	0.0	8,410	
CPT-18/ 15 ft	5	2	6/29/98 7:56	0.000	6.5	1.7	0.0	0.0	14,900	
CPT-28/ 40 ft	12	2	12/1/97 13:33	-0.010	17.0	0.0	0.0	0.0	7,970	
CPT-28/ 40 ft	12	2	1/10/98 11:48	-0.012	19.1	0.0	0.0	0.0	4,590	
CPT-28/ 40 ft	12	2	1/29/98 9:38	-0.040	21.6	0.0	0.0	0.0	7,810	
CPT-28/ 40 ft	12	2	1/29/98 9:38	-0.040	21.8	0.0	0.0	0.0	7,820	Duplicate
CPT-28/ 40 ft	12	2	2/26/98 10:50	-0.010	19.2	0.0	0.0	1.4	6,250	
CPT-28/ 40 ft	12	2	3/24/98 12:40	0.032	11.7	0.0	0.0	0.0	13,700	
CPT-28/ 40 ft	12	2	4/30/98 7:50	-0.035	13.3	0.0	0.0	0.0	8,490	
CPT-21A/ 45 ft	14	2	12/1/97 13:25	-0.022	18.5	0.0	0.0	1.4	8,040	
CPT-21A/ 45 ft	14	2	1/10/98 11:40	-0.010	30.5	0.0	0.0	2.0	4,600	
CPT-21A/ 45 ft	14	2	1/29/98 9:29	-0.027	37.1	0.0	0.0	1.9	7,750	

Table D-2. Carbon Tetrachloride Concentrations Monitored at the 216-Z-9 Wellfield During Nonoperation of the SVE System, October 1997 Through September 1998. (8 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date Time	Differential Pressure (kPa)	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment
CPT-21A/ 45 ft	14	2	2/26/98 10:40	-0.037	21.5	0.0	0.0	1.5	6,370	
CPT-21A/ 45 ft	14	2	3/24/98 11:06	0.042	42.9	0.0	0.0	2.2	10,900	
CPT-21A/ 45 ft	14	2	3/24/98 11:06	0.042	43.0	0.0	0.0	2.3	11,000	Duplicate
CPT-21A/ 45 ft	14	2	4/30/98 8:11	-0.045	41.4	0.0	0.0	2.6	9,140	
CPT-21A/ 45 ft	14	2	5/26/98 7:07	0.057	52.7	1.3	0.0	2.1	8,270	
CPT-21A/ 45 ft	14	2	6/29/98 7:33	-0.067	33.7	2.1	0.0	1.0	14,700	
CPT-28/ 60 ft	18	2	5/26/98 6:52	0.015	1.3	0.0	0.0	0.0	8,100	Substituted for CPT-28/40 ft
CPT-28/ 60 ft	18	2	6/29/98 7:23	-0.012	0.0	3.3	0.0	0.0	14,900	Substituted for CPT-28/40 ft
CPT-28/ 60 ft	18	2	8/14/98 11:54	0.027	1.3	0.0	0.0	0.0	9,750	Substituted for CPT-28/40 ft; analyzed on 8/15/98
CPT-28/ 60 ft	18	2	9/29/98 11:28	0.000	1.5	0.0	0.0	0.0	17,400	Substituted for CPT-28/40 ft
CPT-9A/ 60 ft	18	2	12/1/97 12:25	-0.012	35.8	0.0	0.0	2.3	7,310	
CPT-9A/ 60 ft	18	2	12/1/97 12:25	-0.012	35.8	0.0	0.0	2.6	7,300	Duplicate
CPT-9A/ 60 ft	18	2	1/10/98 15:00	-0.040	37.5	0.0	0.0	2.1	5,580	
CPT-9A/ 60 ft	18	2	1/10/98 15:00	-0.040	37.9	0.0	0.0	2.4	5,620	Duplicate
CPT-9A/ 60 ft	18	2	1/29/98 8:30	0.010	39.1	0.0	0.0	2.3	7,330	
CPT-9A/ 60 ft	18	2	2/26/98 8:54	-0.052	40.9	0.0	0.0	2.8	5,510	
CPT-9A/ 60 ft	18	2	3/24/98 12:03	0.037	38.9	0.0	0.0	2.6	11,000	
CPT-9A/ 60 ft	18	2	4/30/98 11:19	0.007	39.1	0.0	0.0	2.3	13,700	
CPT-9A/ 60 ft	18	2	5/26/98 9:24	0.065	38.8	0.0	0.0	3.7	8,360	
CPT-9A/ 60 ft	18	2	6/29/98 9:30	0.000	38.0	1.3	0.0	1.8	20,200	
CPT-9A/ 60 ft	18	2	8/14/98 12:20	0.080	30.4	0.0	0.0	2.2	9,660	Analyzed on 8/15/98
CPT-9A/ 60 ft	18	2	9/29/98 11:41	0.007	41.1	0.0	0.0	1.0	17,700	

Table D-2. Carbon Tetrachloride Concentrations Monitored at the 216-Z-9 Wellfield During Nonoperation of the SVE System, October 1997 Through September 1998. (8 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date Time	Differential Pressure (kPa)	CCl ₄ (ppmv)	CHCl ₃ (ppmv)	MEK (ppmv)	CH ₂ Cl ₂ (ppmv)	Water (ppmv)	Comment
CPT-24/ 70 ft	21	2	4/30/98 10:28	-0.005	1.8	0.0	0.0	0.0	13,800	Substituted for CPT-24/ 95 ft
CPT-24/ 70 ft	21	2	5/26/98 7:42	0.112	3.2	0.0	0.0	1.7	8,420	Substituted for CPT-24/ 95 ft
CPT-24/ 70 ft	21	2	6/29/98 8:04	-0.060	2.9	0.0	0.0	0.0	15,400	Substituted for CPT-24/ 95 ft
W15-82/ 83 ft	25	2	4/30/98 10:51	0.007	0.0	0.0	0.0	0.0	13,000	Sampled from wellhead without tubing after 3-minute purge
W15-82/ 83 ft	25	2	5/26/98 8:50	0.137	5.5	0.0	0.0	5.5	8,450	Sampled from wellhead without tubing after 3-minute purge
W15-82/ 83 ft	25	2	6/29/98 11:33	0.015	0.0	0.0	0.0	2.3	19,000	Sampled from wellhead without tubing after 3-minute purge
CPT-21A/ 86 ft	26	2	4/30/98 8:15	-0.087	169.0	1.5	0.0	3.1	9,220	
CPT-21A/ 86 ft	26	2	5/26/98 7:12	0.115	168.0	0.0	0.0	3.6	8,230	
CPT-21A/ 86 ft	26	2	6/29/98 7:36	-0.127	206.0	7.5	2.7	3.1	14,500	
W15-95/ 86 ft	26	2	4/30/98 9:44	-0.022	11.9	0.0	0.0	0.0	12,000	Sampled from wellhead without tubing after 3-minute purge
W15-95/ 86 ft	26	2	5/26/98 8:21	0.144	15.0	0.0	0.0	1.5	8,520	Sampled from wellhead without tubing after 3-minute purge
W15-95/ 86 ft	26	2	6/29/98 8:45	-0.075	15.3	1.7	0.0	0.0	19,000	Sampled from wellhead without tubing after 3-minute purge
CPT-28/ 87 ft	27	2	4/30/98 8:04	-0.087	229.0	1.6	0.0	2.4	9,050	
CPT-28/ 87 ft	27	2	5/26/98 7:00	0.110	229.0	1.8	0.0	1.7	8,160	
CPT-28/ 87 ft	27	2	6/29/98 7:26	-0.130	230.0	2.8	0.0	1.3	14,500	
CPT-9A/ 91 ft	28	2	4/30/98 11:24	0.002	27.6	0.0	0.0	1.9	10,500	
CPT-9A/ 91 ft	28	2	5/26/98 9:29	0.067	34.5	0.0	0.0	3.2	8,190	
CPT-9A/ 91 ft	28	2	6/29/98 9:35	-0.045	33.6	0.0	0.0	1.7	15,800	

Table D-2. Carbon Tetrachloride Concentrations Monitored at the 216-Z-9 Wellfield During Nonoperation of the SVE System, October 1997 Through September 1998. (8 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date Time	Differential Pressure (kPa)	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment
W15-218U/ 106 ft	32	3	4/30/98 10:03	0.080	0.0	0.0	0.0	1.1	12,900	Sampled from wellhead without tubing after 3-minute purge
W15-218U/ 106 ft	32	3	4/30/98 10:10	0.080	0.0	0.0	0.0	0.0	12,400	Sampled from wellhead without tubing after 10-minute purge
W15-218U/ 106 ft	32	3	5/26/98 8:06	0.229	0.0	0.0	0.0	0.0	8,300	Sampled from wellhead without tubing after 3-minute purge
W15-218U/ 106 ft	32	3	5/26/98 8:11	0.229	0.0	0.0	0.0	0.0	8,270	Sampled from wellhead without tubing after 10-minute purge
W15-218U/ 106 ft	32	3	6/29/98 8:36	-0.227	0.0	1.9	0.0	0.0	18,000	Sampled from wellhead without tubing after 3-minute purge
W15-223/ 110 ft	34	3	4/30/98 10:22	0.010	0.0	0.0	0.0	0.0	15,000	Sampled from wellhead without tubing after 3-minute purge
W15-223/ 110 ft	34	3	5/26/98 7:55	0.154	2.2	0.0	0.0	0.0	8,340	Sampled from wellhead without tubing after 3-minute purge
W15-223/ 110 ft	34	3	6/29/98 8:25	-0.085	0.0	0.0	0.0	0.0	12,900	Sampled from wellhead without tubing after 3-minute purge
W15-217/ 114 ft	35	3	3/24/98 11:22	0.077	95.7	0.0	0.0	0.0	9,510	Sampled from wellhead without tubing after 3-minute purge
W15-217/ 114 ft	35	3	4/30/98 8:52	-0.057	18.8	0.0	0.0	0.0	8,880	Sampled from wellhead without tubing after 3-minute purge
W15-217/ 114 ft	35	3	4/30/98 8:59	-0.057	25.4	1.0	0.0	0.0	8,770	Sampled from wellhead without tubing after 10 minute purge
W15-217/ 114 ft	35	3	5/26/98 7:25	0.174	630.0	5.2	0.0	0.0	8,480	Tubing installed 5/19/98
W15-217/ 114 ft	35	3	5/26/98 7:25	0.174	458.0	5.3	0.0	1.4	8,480	Duplicate
W15-217/ 114 ft	35	3	6/29/98 7:50	-0.157	504.0	4.2	0.0	1.2	14,400	
CPT-24/ 118 ft	36	3	4/30/98 9:30	-0.080	37.7	1.6	1.6	2.9	10,200	

Table D-2. Carbon Tetrachloride Concentrations Monitored at the 216-Z-9 Wellfield During Nonoperation of the SVE System, October 1997 Through September 1998. (8 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date Time	Differential Pressure (kPa)	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment
CPT-24/ 118 ft	36	3	4/30/98 9:30	-0.080	38.0	1.7	1.6	2.6	9,710	Duplicate
CPT-24/ 118 ft	36	3	5/26/98 7:48	0.224	36.5	0.0	0.0	2.7	8,420	
CPT-24/ 118 ft	36	3	6/29/98 8:08	-0.172	37.5	1.8	1.2	3.0	15,700	
CPT-24/ 118 ft	36	3	6/29/98 8:08	-0.172	37.8	1.9	1.4	2.3	15,700	Duplicate
W15-9L/ 176 ft	53	6	12/1/97	--	--	--	--	--	--	Not in service
W15-9L/ 176 ft	53	6	1/10/98 15:10	0.050	13.3	0.0	0.0	1.3	5,680	
W15-9L/ 176 ft	53	6	1/29/98	--	--	--	--	--	--	Unable to sample; radiological concern
W15-9L/ 176 ft	53	6	2/5/98 8:00	-0.740	14.6	0.0	0.0	1.3	7,940	
W15-9L/ 176 ft	53	6	2/5/98 8:00	-0.740	14.6	0.0	0.0	1.1	7,970	Duplicate
W15-9L/ 176 ft	53	6	2/26/98 9:34	-0.543	8.7	0.0	0.0	1.2	5,810	
W15-9L/ 176 ft	53	6	3/24/98 11:35	0.204	14.6	0.0	0.0	1.7	9,780	
W15-9L/ 176 ft	53	6	4/30/98 9:52	0.092	14.0	0.0	0.0	1.6	10,900	
W15-9L/ 176 ft	53	6	5/26/98 8:27	0.254	15.0	0.0	0.0	2.4	8,420	
W15-9L/ 176 ft	53	6	6/29/98 8:51	-0.249	8.6	2.0	0.0	0.0	18,800	
W15-216L/ 180 ft	55	5	12/1/97	--	--	--	--	--	--	Not in service
W15-216L/ 180 ft	55	5	1/10/98 8:54	-0.095	14.1	0.0	0.0	0.0	4,190	
W15-216L/ 180 ft	55	5	1/29/98 8:11	0.177	15.5	0.0	0.0	0.0	7,380	
W15-216L/ 180 ft	55	5	2/26/98 8:33	-0.568	15.0	0.0	0.0	1.2	5,630	
W15-216L/ 180 ft	55	5	3/24/98 12:52	0.291	17.3	0.0	0.0	0.0	13,400	
W15-216L/ 180 ft	55	5	4/30/98 11:00	0.012	15.0	1.1	1.0	0.0	14,100	
W15-216L/ 180 ft	55	5	5/26/98 8:59	0.120	15.3	0.0	0.0	1.6	8,480	
W15-216L/ 180 ft	55	5	6/29/98 11:38	-0.012	12.8	3.4	1.9	4.1	21,500	
W15-6L/ 182 ft	55	6	12/1/97	--	--	--	--	--	--	Not in service

Table D-2. Carbon Tetrachloride Concentrations Monitored at the 216-Z-9 Wellfield During Nonoperation of the SVE System, October 1997 Through September 1998. (8 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date Time	Differential Pressure (kPa)	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment
W15-6L/ 182 ft	55	6	1/10/98 9:52	-0.067	15.2	0.0	0.0	1.9	5,620	
W15-6L/ 182 ft	55	6	1/29/98 8:53	0.807	16.1	0.0	0.0	2.2	7,490	
W15-6L/ 182 ft	55	6	2/26/98 9:20	-0.545	16.1	0.0	0.0	2.8	5,860	
W15-6L/ 182 ft	55	6	3/24/98 11:40	0.214	16.3	0.0	0.0	2.0	11,100	
W15-6L/ 182 ft	55	6	4/30/98 10:36	0.095	16.4	0.0	0.0	2.3	14,400	
W15-6L/ 182 ft	55	6	5/26/98 8:34	0.252	17.8	0.0	0.0	2.2	8,470	
W15-6L/ 182 ft	55	6	6/29/98 8:57	-0.252	17.6	1.6	0.0	2.5	18,200	

Note: Concentrations recorded in this table as 0.0 ppmv were measured as <1.0 ppmv.

-- = no data

bgs = below ground surface

CCl4 = carbon tetrachloride

CH2Cl2 = methylene chloride

CHCl3 = chloroform

MEK = methylethyl ketone

ppmv = parts per million by volume

Table D-3. Carbon Tetrachloride Concentration Standard Analyses, October 1997 Through September 1998.

Carbon Tetrachloride Concentration Standard (ppmv)	Carbon Tetrachloride Concentration Analyzed (ppmv)	Date Analyzed	Time Analyzed	B&K Serial Number
27.6	24.9	12/01/97	15:32	1747619
27.6	24.3	01/10/98	15:29	1747619
27.6	24.0	01/29/98	12:40	1747619
27.6	24.1	02/05/98	8:36	1747619
27.6	25.2	02/26/98	14:04	1747619
27.6	23.9	03/25/98	9:32	1747619
27.6	24.6	04/30/98	11:54	1747619
27.6	23.3	05/26/98	15:57	1732828
27.6	23.2	06/29/98	9:56	1732828
25.5	24.6	08/14/98	7:19	1715232
25.5	25.5	08/14/98	8:08	1715232
25.5	25.4	09/29/98	11:59	1715232
25.5	25.4	09/29/98	12:55	1715232

Appendix D – FY 1998 Soil Vapor Monitoring Data

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Table D-4. Blank Analyses^a, October 1997 Through September 1998.

Sample Location	Sample Date	Sample Time	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)
Blank	12/01/97	15:30	0.0	0.0	0.0	0.0	6,810
Blank	12/01/97	16:19	0.0	0.0	0.0	0.0	7,200
Blank	01/10/98	15:25	0.0	0.0	0.0	0.0	5,000
Blank	01/10/98	16:21	0.0	0.0	0.0	0.0	4,020
Blank	01/29/98	12:38	0.0	0.0	0.0	0.0	7,300
Blank	01/29/98	13:36	0.0	0.0	0.0	0.0	8,160
Blank	02/05/98	8:34	0.0	0.0	0.0	0.0	7,850
Blank	02/05/98	8:42	0.0	0.0	0.0	0.0	8,050
Blank	02/26/98	14:02	0.0	0.0	0.0	0.0	5,720
Blank	02/26/98	14:56	0.0	0.0	0.0	0.0	5,080
Blank	03/24/98	13:05	0.0	0.0	0.0	0.0	8,190
Blank	03/24/98	14:01	0.0	0.0	0.0	0.0	7,770
Blank	04/30/98	11:52	0.0	0.0	0.0	0.0	11,700
Blank	04/30/98	12:52	0.0	0.0	0.0	0.0	8,320
Blank	05/26/98	15:59	0.0	1.5	0.0	0.0	8,970
Blank	05/26/98	16:57	0.0	0.0	0.0	0.0	8,510
Blank	06/29/98	9:53	0.0	0.0	0.0	0.0	8,790
Blank	06/29/98	10:44	0.0	0.0	0.0	0.0	11,700
Blank	06/29/98	11:53	0.0	0.0	0.0	0.0	9,180
Blank	06/29/98	12:01	0.0	0.0	0.0	0.0	11,000
Blank	08/14/98	7:20	0.0	0.0	0.0	0.0	9,100
Blank	08/14/98	8:10	0.0	0.0	0.0	0.0	10,500
Blank	09/29/98	11:57	0.0	0.0	0.0	0.0	9,480
Blank	09/29/98	12:57	0.0	0.0	0.0	0.0	9,470

Note: Concentrations recorded in this table as 0.0 ppmv were measured as <1.0 ppmv.

^a Analyses of the vapor headspace in blank samples of deionized water.

CCl4 = carbon tetrachloride

CHCl3 = chloroform

MEK = methylethyl ketone

CH2Cl2 = methylene chloride

APPENDIX E

FISCAL YEAR 1999 SOIL VAPOR MONITORING DATA

Table E-1. Carbon Tetrachloride Concentrations Monitored at the 216-Z-1A/Z-18/Z-12 Wellfield During Nonoperation of the SVE System, October 1998 Through September 1999. (8 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date Time	Differential Pressure (kPa)	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment	CO2 (%)
79-03/ 5 ft	2	1	4/26/1999 8:36	-0.002	0.0	0.0	0.0	0.0	5,400		
79-03/ 5 ft	2	1	5/25/1999 8:03	0.005	0.0	0.0	0.0	0.0	9,910		
79-03/ 5 ft	2	1	6/28/1999 7:44	0.002	0.0	0.0	0.0	0.0	10,400		
79-06/ 5 ft	2	1	11/5/1998 8:30	-0.025	0.0	0.0	0.0	0.0	13,400		
79-06/ 5 ft	2	1	12/1/1998 8:07	-0.090	0.0	0.0	0.0	0.0	7,490		
79-06/ 5 ft	2	1	12/31/1998 8:05	-0.110	0.0	0.0	0.0	0.0	9,080		
79-06/ 5 ft	2	1	1/26/1999 7:51	-0.057	0.0	0.0	0.0	0.0	5,880		
79-06/ 5 ft	2	1	2/23/1999 9:09	-0.007	1.2	0.0	0.0	0.0	7,930		
79-06/ 5 ft	2	1	3/22/1999 8:39	0.002	0.0	0.0	0.0	0.0	8,680		
79-06/ 5 ft	2	1	4/26/1999 10:38	0.002	0.0	0.0	0.0	0.0	7,210		
79-06/ 5 ft	2	1	5/25/1999 9:40	0.005	1.4	0.0	0.0	0.0	10,400		
79-06/ 5 ft	2	1	6/28/1999 9:14	0.005	1.2	0.0	0.0	0.0	13,000		
79-11/ 5 ft	2	1	11/5/1998 9:02	0.000	2.8	0.0	0.0	0.0	13,100		
79-11/ 5 ft	2	1	12/1/1998 8:38	-0.005	0.0	0.0	0.0	0.0	7,610		
79-11/ 5 ft	2	1	12/31/1998 8:23	-0.005	2.9	0.0	0.0	0.0	9,040		
79-11/ 5 ft	2	1	1/26/1999 8:17	-0.015	1.9	0.0	0.0	0.0	6,010		
79-11/ 5 ft	2	1	2/23/1999 9:30	0.000	1.6	0.0	0.0	0.0	8,210		
79-11/ 5 ft	2	1	3/22/1999 9:30	0.005	2.5	0.0	0.0	0.0	9,530		
79-11/ 5 ft	2	1	4/26/1999 11:04	-0.057	1.5	0.0	0.0	0.0	8,100		
79-11/ 5 ft	2	1	5/25/1999 11:00	0.005	1.4	0.0	0.0	0.0	14,500		
79-11/ 5 ft	2	1	6/28/1999 9:32	0.005	0.0	0.0	0.0	0.0	14,600		
87-05/ 5 ft	2	1	4/26/1999 10:48	0.005	1.0	0.0	0.0	0.0	7,670		
87-05/ 5 ft	2	1	5/25/1999 10:47	-0.005	1.0	0.0	0.0	0.0	12,300		
87-05/ 5 ft	2	1	6/28/1999 9:25	0.002	0.0	0.0	0.0	0.0	13,600		
87-09/ 5 ft	2	1	11/5/1998 9:29	0.000	0.0	0.0	0.0	0.0	12,900		

Table E-1. Carbon Tetrachloride Concentrations Monitored at the 216-Z-1A/Z-18/Z-12 Wellfield During Nonoperation of the SVE System, October 1998 Through September 1999. (8 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date Time	Differential Pressure (kPa)	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment	CO2 (%)
87-09/ 5 ft	2	1	12/1/1998 9:11	0.000	0.0	0.0	0.0	0.0	7,770		
87-09/ 5 ft	2	1	12/31/1998 8:46	-0.010	1.1	0.0	0.0	0.0	8,870		
87-09/ 5 ft	2	1	1/26/1999 8:45	-0.015	0.0	0.0	0.0	0.0	6,100		
87-09/ 5 ft	2	1	2/23/1999 9:49	0.002	0.0	0.0	0.0	0.0	8,380		
87-09/ 5 ft	2	1	3/22/1999 9:55	-0.115	1.2	0.0	0.0	0.0	9,890		
87-09/ 5 ft	2	1	4/26/1999 11:26	0.002	2.6	0.0	0.0	0.0	8,790		
87-09/ 5 ft	2	1	5/25/1999 11:20	0.045	2.4	0.0	0.0	0.0	19,800		
87-09/ 5 ft	2	1	6/28/1999 9:53	0.005	2.3	0.0	0.0	0.0	16,000		
CPT-13A/ 9 ft	3	2	4/26/1999 11:10	0.010	0.0	0.0	0.0	0.0	8,040		
CPT-13A/ 9 ft	3	2	5/25/1999 11:04	-0.005	1.0	0.0	0.0	0.0	13,700		
CPT-13A/ 9 ft	3	2	6/28/1999 9:37	0.007	0.0	0.0	0.0	0.0	12,200		
CPT-31/ 25 ft	8	2	4/26/1999 10:15	0.002	0.0	0.0	0.0	0.0	6,380		
CPT-31/ 25 ft	8	2	5/25/1999 8:52	-0.002	0.0	0.0	0.0	0.0	10,600		
CPT-31/ 25 ft	8	2	6/28/1999 8:26	0.000	0.0	0.0	0.0	0.0	10,800		
CPT-32/ 25 ft	8	2	11/5/1998 8:37	0.000	1.0	1.1	0.0	0.0	12,700		
CPT-32/ 25 ft	8	2	12/1/1998 8:15	-0.015	2.1	0.0	0.0	0.0	7,490		
CPT-32/ 25 ft	8	2	12/31/1998 8:11	-0.010	5.2	0.0	0.0	0.0	8,920		
CPT-32/ 25 ft	8	2	1/26/1999 8:02	-0.020	7.0	0.0	0.0	0.0	5,660		
CPT-32/ 25 ft	8	2	2/23/1999 9:15	0.000	7.4	0.0	0.0	0.0	8,150		
CPT-32/ 25 ft	8	2	3/22/1999 8:46	0.005	8.3	0.0	0.0	0.0	8,950		
CPT-32/ 25 ft	8	2	4/26/1999 10:43	0.000	10.0	0.0	0.0	0.0	7,770		
CPT-32/ 25 ft	8	2	5/25/1999 9:45	-0.002	9.1	0.0	0.0	0.0	11,400		
CPT-32/ 25 ft	8	2	6/28/1999 9:20	0.007	8.4	0.0	0.0	0.0	12,200		
CPT-30/ 28 ft	9	2	11/5/1998 8:04	-0.002	0.0	1.1	0.0	0.0	12,600		
CPT-30/ 28 ft	9	2	12/1/1998 7:46	-0.005	0.0	0.0	0.0	0.0	7,410		
CPT-30/ 28 ft	9	2	12/31/1998 7:47	-0.007	0.0	0.0	0.0	0.0	8,860		

Table E-1. Carbon Tetrachloride Concentrations Monitored at the 216-Z-1A/Z-18/Z-12 Wellfield During Nonoperation of the SVE System, October 1998 Through September 1999. (8 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date Time	Differential Pressure (kPa)	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment	CO2 (%)
CPT-30/ 28 ft	9	2	1/26/1999 7:35	-0.022	0.0	0.0	0.0	0.0	5,640		
CPT-30/ 28 ft	9	2	2/23/1999 8:52	0.010	0.0	0.0	0.0	0.0	7,920		
CPT-30/ 28 ft	9	2	3/22/1999 8:23	-0.139	0.0	0.0	0.0	0.0	8,720		
CPT-30/ 28 ft	9	2	4/26/1999 10:02	-0.189	3.2	0.0	0.0	0.0	6,590		
CPT-30/ 28 ft	9	2	5/25/1999 8:39	-0.005	0.0	0.0	0.0	0.0	10,300		
CPT-30/ 28 ft	9	2	6/28/1999 8:10	-0.005	0.0	0.0	0.0	0.0	10,600		
CPT-7A/ 32 ft	10	2	11/5/1998 9:43	-0.005	1.7	0.0	0.0	0.0	13,300		
CPT-7A/ 32 ft	10	2	12/1/1998 9:17	0.000	2.4	0.0	0.0	0.0	7,990		
CPT-7A/ 32 ft	10	2	12/31/1998 8:51	-0.025	2.6	0.0	0.0	0.0	8,830		
CPT-7A/ 32 ft	10	2	1/26/1999 9:13	-0.040	5.4	0.0	0.0	0.0	6,260		
CPT-7A/ 32 ft	10	2	2/23/1999 9:55	0.015	3.5	0.0	0.0	0.0	8,300		
CPT-7A/ 32 ft	10	2	3/22/1999 10:01	0.022	3.5	0.0	0.0	0.0	9,630		
CPT-7A/ 32 ft	10	2	4/26/1999 11:31	0.005	3.2	0.0	0.0	0.0	8,720		
CPT-7A/ 32 ft	10	2	5/25/1999 11:24	0.005	3.7	0.0	0.0	0.0	21,300		
CPT-7A/ 32 ft	10	2	6/28/1999 9:58	0.017	2.6	0.0	0.0	0.0	15,000		
CPT-1A/ 35 ft	11	2	4/26/1999 8:21	-0.002	2.8	0.0	0.0	0.0	5,140		
CPT-1A/ 35 ft	11	2	5/25/1999 7:53	-0.017	3.0	0.0	0.0	0.0	10,000		
CPT-1A/ 35 ft	11	2	6/28/1999 7:30	-0.002	2.1	0.0	0.0	0.0	9,540		
CPT-33/ 40 ft	12	2	4/26/1999 9:09	-0.002	2.3	0.0	0.0	0.0	5,440		
CPT-33/ 40 ft	12	2	5/25/1999 8:27	-0.027	2.6	0.0	0.0	0.0	10,300		
CPT-33/ 40 ft	12	2	6/28/1999 7:59	-0.005	2.1	0.0	0.0	0.0	10,100		
CPT-34/ 40 ft	12	2	4/26/1999 8:44	-0.080	1.3	0.0	0.0	0.0	5,410		
CPT-34/ 40 ft	12	2	5/25/1999 8:10	-0.007	1.4	0.0	0.0	0.0	9,990		
CPT-34/ 40 ft	12	2	6/28/1999 7:51	-0.005	1.5	0.0	0.0	0.0	10,500		
CPT-34/ 40 ft	12	2	7/30/1999 7:22	-0.012	1.7	0.0	0.0	0.0	13,100		
CPT-34/ 40 ft	12	2	9/14/1999 8:59	-0.002	1.1	0.0	0.0	0.0	8,680		0.0

Table E-1. Carbon Tetrachloride Concentrations Monitored at the 216-Z-1A/Z-18/Z-12 Wellfield During Nonoperation of the SVE System, October 1998 Through September 1999. (8 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date Time	Differential Pressure (kPa)	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment	CO2 (%)
CPT-34/ 40 ft	12	2	9/28/1999 8:48	-0.020	1.1	0.0	0.0	0.0	5,660		
CPT-30/ 68 ft	21	2	4/26/1999 10:09	0.015	3.0	1.0	0.0	1.7	6,240		
CPT-30/ 68 ft	21	2	5/25/1999 8:45	-0.060	1.6	0.0	0.0	1.5	9,940		
CPT-30/ 68 ft	21	2	6/28/1999 8:15	-0.012	1.7	0.0	0.0	1.4	9,470		
CPT-13A/ 70 ft	21	2	4/26/1999 11:14	0.020	5.3	0.0	0.0	0.0	8,140		
CPT-13A/ 70 ft	21	2	5/25/1999 11:08	-0.007	5.4	0.0	0.0	0.0	16,300		
CPT-13A/ 70 ft	21	2	6/28/1999 9:41	-0.012	5.6	0.0	0.0	0.0	14,400		
CPT-31/ 76 ft	23	2	4/26/1999 10:20	-0.057	4.2	1.4	0.0	0.0	6,580		
CPT-31/ 76 ft	23	2	5/25/1999 8:56	-0.122	2.2	0.0	0.0	0.0	10,500		
CPT-31/ 76 ft	23	2	6/28/1999 8:30	-0.032	3.2	0.0	0.0	0.0	10,800		
CPT-33/ 80 ft	24	2	4/26/1999 9:13	-0.062	7.6	1.5	0.0	1.0	5,710		
CPT-33/ 80 ft	24	2	5/25/1999 8:32	-0.192	8.5	0.0	0.0	1.0	10,600		
CPT-33/ 80 ft	24	2	6/28/1999 8:03	-0.042	9.2	1.0	0.0	0.0	10,600		
CPT-34/ 86 ft	26	2	4/26/1999 8:56	-0.127	0.0	5.2	2.6	2.7	4,380	Sample very difficult to pull, approx. 1/8-L purge and sample	
CPT-34/ 86 ft	26	2	5/25/1999	-0.050	--	--	--	--	--	Unable to pull sample from CPT-34/ 86 ft or CPT-34/ 60 ft	
CPT-34/ 86 ft	26	2	6/28/1999	-0.027	--	--	--	--	--	Unable to pull sample from CPT-34/ 86 ft or CPT-34/ 60 ft	
CPT-1A/ 91 ft	28	2	4/26/1999 8:27	-0.005	4.2	0.0	0.0	0.0	4,680		
CPT-1A/ 91 ft	28	2	5/25/1999 7:57	0.007	0.0	0.0	0.0	0.0	9,410		
CPT-1A/ 91 ft	28	2	6/28/1999 7:35	0.002	2.4	0.0	0.0	0.0	8,820		
CPT-1A/ 91 ft	28	2	7/30/1999 7:14	-0.002	2.1	0.0	0.0	0.0	12,100		
CPT-1A/ 91 ft	28	2	9/14/1999 8:47	-0.007	3.3	1.3	0.0	3.1	8,500		0.0
CPT-1A/ 91 ft	28	2	9/28/1999 8:38	-0.015	0.0	0.0	0.0	0.0	5,360		
CPT-4A/ 91 ft	28	2	4/26/1999 10:29	-0.002	10.9	0.0	0.0	3.1	7,200		
CPT-4A/ 91 ft	28	2	5/25/1999 9:30	-0.164	14.1	0.0	0.0	3.3	10,300		

Table E-1. Carbon Tetrachloride Concentrations Monitored at the 216-Z-1A/Z-18/Z-12 Wellfield During Nonoperation of the SVE System, October 1998 Through September 1999. (8 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date Time	Differential Pressure (kPa)	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment	CO2 (%)
CPT-4A/ 91 ft	28	2	5/25/1999 9:30	-0.164	14.1	0.0	0.0	3.4	10,200	Duplicate	
CPT-4A/ 91 ft	28	2	6/28/1999 9:05	-0.057	14.4	0.0	0.0	2.6	11,500		
W18-252SST/ 100 ft	30	2	11/5/1998 8:21	0.045	18.2	0.0	0.0	0.0	14,200		
W18-252SST/ 100 ft	30	2	12/1/1998 7:55	-0.247	13.3	0.0	0.0	0.0	7,610		
W18-252SST/ 100 ft	30	2	12/31/1998 7:55	0.040	22.7	0.0	0.0	0.0	9,100		
W18-252SST/ 100 ft	30	2	1/26/1999 7:43	-0.022	10.7	0.0	0.0	0.0	5,940		
W18-252SST/ 100 ft	30	2	2/23/1999 8:59	0.015	24.0	0.0	0.0	0.0	8,050		
W18-252SST/ 100 ft	30	2	3/22/1999 8:31	0.015	23.2	0.0	0.0	0.0	8,710		
W18-152/ 101 ft	31	2	11/5/1998 7:44	0.050	27.9	0.0	0.0	0.0	13,400		
W18-152/ 101 ft	31	2	12/1/1998 7:23	-0.281	3.4	0.0	0.0	0.0	7,530		
W18-152/ 101 ft	31	2	12/31/1998 7:25	0.022	25.2	0.0	0.0	0.0	8,890		
W18-152/ 101 ft	31	2	1/26/1999 7:20	-0.077	31.7	0.0	0.0	0.0	5,920		
W18-152/ 101 ft	31	2	2/23/1999 8:34	-0.005	33.3	0.0	0.0	1.9	7,960		
W18-152/ 101 ft	31	2	3/22/1999 8:06	0.010	3.3	0.0	0.0	0.0	8,810		
W18-152/ 101 ft	31	2	3/22/1999 8:06	0.010	3.1	0.0	0.0	0.0	8,640	Duplicate	
W18-152/ 101 ft	31	2	4/26/1999 8:14	-0.055	4.7	0.0	0.0	0.0	5,090		
W18-152/ 101 ft	31	2	5/25/1999 7:45	-0.162	4.4	0.0	0.0	0.0	10,100		
W18-152/ 101 ft	31	2	6/28/1999 7:24	-0.017	2.0	0.0	0.0	0.0	9,490		
W18-167/ 106 ft	32	3	11/5/1998 10:05	0.007	127.0	1.3	0.0	4.4	13,800		
W18-167/ 106 ft	32	3	12/1/1998 12:06	-0.025	205.0	1.9	0.0	5.9	9,310		
W18-167/ 106 ft	32	3	12/31/1998	--	--	--	--	--	--	Unable to gain access to Z-1A crib to sample	
W18-167/ 106 ft	32	3	1/26/1999 9:06	-0.164	228.0	1.8	0.0	4.2	6,340		
W18-167/ 106 ft	32	3	2/23/1999 11:22	0.075	218.0	2.1	0.0	3.2	10,300		
W18-167/ 106 ft	32	3	3/22/1999 9:19	0.040	195.0	1.9	0.0	5.1	9,060		
W18-167/ 106 ft	32	3	4/26/1999 9:52	-0.030	211.0	1.4	0.0	5.6	6,010		
W18-167/ 106 ft	32	3	5/25/1999 9:17	-0.147	219.0	1.4	0.0	5.1	10,800		

Table E-1. Carbon Tetrachloride Concentrations Monitored at the 216-Z-1A/Z-18/Z-12 Wellfield During Nonoperation of the SVE System, October 1998 Through September 1999. (8 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date Time	Differential Pressure (kPa)	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment	CO2 (%)
W18-167/ 106 ft	32	3	6/28/1999 8:45	-0.055	173.0	1.2	0.0	5.8	11,100		
W18-167/ 106 ft	32	3	6/28/1999 8:45	-0.055	174.0	1.4	0.0	4.4	11,100	Duplicate	
W18-158L/ 120 ft	37	3	11/5/1998 9:57	0.017	172.0	0.0	5.8	167.0	14,200		
W18-158L/ 120 ft	37	3	12/1/1998 11:58	-0.032	172.0	0.0	4.5	123.0	9,000		
W18-158L/ 120 ft	37	3	12/31/1998	--	--	--	--	--	--	Unable to gain access to Z-1A crib to sample	
W18-158L/ 120 ft	37	3	1/26/1999 8:55	-0.144	267.0	0.0	4.3	118.0	6,230		
W18-158L/ 120 ft	37	3	2/23/1999 11:16	0.065	288.0	0.0	4.3	116.0	9,950		
W18-158L/ 120 ft	37	3	3/22/1999 9:12	0.015	399.0	1.4	4.2	127.0	8,900		
W18-158L/ 120 ft	37	3	4/26/1999 9:47	-0.037	492.0	0.0	5.5	132.0	6,180		
W18-158L/ 120 ft	37	3	5/25/1999 9:12	-0.167	329.0	0.0	5.5	137.0	10,400		
W18-158L/ 120 ft	37	3	6/28/1999 8:40	-0.052	310.0	0.0	5.8	142.0	10,600		
W18-249/ 130 ft	40	3	11/5/1998 8:53	0.037	215.0	2.3	0.0	0.0	14,100		
W18-249/ 130 ft	40	3	12/1/1998 8:22	-0.269	23.3	0.0	0.0	0.0	7,720		
W18-249/ 130 ft	40	3	12/31/1998 8:17	0.012	208.0	1.5	0.0	0.0	8,920		
W18-249/ 130 ft	40	3	1/26/1999 8:08	-0.105	188.0	0.0	0.0	1.6	6,110		
W18-249/ 130 ft	40	3	2/23/1999 9:21	0.000	139.0	0.0	0.0	1.5	8,350		
W18-249/ 130 ft	40	3	3/22/1999 8:54	0.017	76.9	1.2	0.0	0.0	8,770		
W18-249/ 130 ft	40	3	4/26/1999 10:55	0.000	81.1	0.0	0.0	0.0	6,730		
W18-249/ 130 ft	40	3	5/25/1999 10:52	-0.112	77.1	0.0	0.0	0.0	12,400		
W18-249/ 130 ft	40	3	6/28/1999 8:54	-0.065	90.9	0.0	0.0	0.0	10,400		
W18-248/ 131 ft	40	3	11/5/1998 9:09	0.085	93.5	2.0	0.0	1.3	13,800		
W18-248/ 131 ft	40	3	12/1/1998 8:48	-0.374	98.0	1.4	0.0	2.2	7,900		
W18-248/ 131 ft	40	3	12/31/1998 8:29	0.085	138.0	1.3	0.0	1.7	8,980		
W18-248/ 131 ft	40	3	1/26/1999 8:24	-0.090	136.0	1.1	0.0	1.5	6,240		
W18-248/ 131 ft	40	3	2/23/1999 9:37	0.015	148.0	1.2	0.0	1.5	8,460		
W18-248/ 131 ft	40	3	3/22/1999 9:36	0.020	144.0	1.4	0.0	1.2	9,170		

Table E-1. Carbon Tetrachloride Concentrations Monitored at the 216-Z-1A/Z-18/Z-12 Wellfield During Nonoperation of the SVE System, October 1998 Through September 1999. (8 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date Time	Differential Pressure (kPa)	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment	CO2 (%)
W18-248/ 131 ft	40	3	4/26/1999 11:20	-0.012	162.0	1.5	0.0	2.0	7,660		
W18-248/ 131 ft	40	3	5/25/1999 11:14	-0.125	177.0	2.3	0.0	1.1	16,200		
W18-248/ 131 ft	40	3	6/28/1999 9:48	-0.077	152.0	1.2	0.0	1.3	13,500		
W18-7/ 197 ft	60	6	11/5/1998 9:23	0.351	22.5	0.0	0.0	0.0	13,700		
W18-7/ 197 ft	60	6	12/1/1998 8:54	-0.518	21.8	0.0	0.0	1.1	7,850		
W18-7/ 197 ft	60	6	12/31/1998 8:35	0.413	26.7	0.0	0.0	0.0	8,990		
W18-7/ 197 ft	60	6	1/26/1999 8:31	0.035	26.4	0.0	0.0	0.0	6,270		
W18-7/ 197 ft	60	6	2/23/1999 9:42	0.072	28.4	0.0	0.0	0.0	8,590		
W18-7/ 197 ft	60	6	3/22/1999 9:42	-0.162	29.0	0.0	0.0	0.0	9,540		
W18-12/ 198 ft	60	6	11/5/1998 7:53	0.418	7.5	0.0	0.0	7.3	13,700		
W18-12/ 198 ft	60	6	12/1/1998 7:35	-0.508	12.0	0.0	0.0	5.9	7,560		
W18-12/ 198 ft	60	6	12/31/1998 7:40	0.481	13.6	0.0	0.0	7.1	9,100		
W18-12/ 198 ft	60	6	1/26/1999 7:27	0.329	12.2	0.0	0.0	5.8	6,030		
W18-12/ 198 ft	60	6	2/23/1999 8:43	0.047	18.5	0.0	0.0	4.7	8,050		
W18-12/ 198 ft	60	6	3/22/1999 8:14	-0.274	15.9	0.0	0.0	3.5	8,620		
W18-6L/ 208 ft	63	6	11/5/1998	--	--	--	--	--	--	W18-6L found with tubing cut	
W18-6L/ 208 ft	63	6	12/1/1998	--	--	--	--	--	--	Not in service	
W18-6L/ 208 ft	63	6	12/31/1998	--	--	--	--	--	--	Not in service	
W18-6L/ 208 ft	63	6	1/26/1999	--	--	--	--	--	--	Not in service	
W18-6L/ 208 ft	63	6	2/23/1999	--	--	--	--	--	--	Not in service	
W18-6L/ 208 ft	63	6	3/22/1999	--	--	--	--	--	--	Not in service	

Note: Concentrations recorded in this table as 0.0 ppmv were measured as <1.0 ppmv.

-- = no data

bgs = below ground surface

CCl4 = carbon tetrachloride

CH2Cl2 = methylene chloride

CHCl3 = chloroform

CO2 = carbon dioxide

MEK = methylethyl ketone

ppmv = parts per million by volume

Table E-2. Carbon Tetrachloride Concentrations Monitored at the 216-Z-9 Wellfield During Nonoperation of the SVE System, October 1998 Through September 1999. (9 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date Time	Differential Pressure (kPa)	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment	CO2 (%)
86-05/ 5 ft	2	1	7/30/1999	--	--	--	--	--	--	SGP 86-05 destroyed	
86-05/ 5 ft	2	1	9/28/1999 9:33	0.000	0.0	0.0	0.0	0.0	6,450		
86-05-01/ 5 ft	2	1	9/14/1999	--	--	--	--	--	--	Unable to locate sample point	
86-06/ 5 ft	2	1	12/1/1998 10:52	0.005	0.0	0.0	0.0	0.0	8,420	Substitute for 86-07R	
86-06/ 5 ft	2	1	12/31/1998 10:15	-0.007	0.0	0.0	0.0	0.0	9,890		
86-06/ 5 ft	2	1	1/26/1999 10:34	-0.047	0.0	0.0	0.0	0.0	7,640		
86-06/ 5 ft	2	1	2/23/1999 11:38	0.005	1.5	0.0	0.0	0.0	10,500		
86-06/ 5 ft	2	1	3/22/1999 10:36	0.012	1.9	0.0	0.0	0.0	9,430		
86-06/ 5 ft	2	1	7/30/1999	--	--	--	--	--	--	Pump failure	
86-06/ 5 ft	2	1	9/14/1999 11:31	0.012	0.0	0.0	0.0	1.3	10,600		0.0
86-06/ 5 ft	2	1	9/28/1999 11:28	0.007	0.0	0.0	0.0	0.0	8,180		
86-07R/ 5 ft	2	1	11/5/1998	--	--	--	--	--	--	Destroyed; substitute 86-06	
94-02/ 5 ft	2	1	7/30/1999 8:32	0.010	1.4	1.1	0.0	0.0	16,100		
94-02/ 5 ft	2	1	9/14/1999 10:37	0.007	0.0	0.0	0.0	1.8	10,000		0.0
94-02/ 5 ft	2	1	9/28/1999 10:31	0.002	0.0	0.0	0.0	0.0	8,480		
94-02/ 5 ft	2	1	3/22/1999	--	--	--	--	--	--	Unable to locate SGP 94-02 (construction)	
95-11/ 5 ft	2	1	11/5/1998 10:48	0.002	0.0	0.0	0.0	0.0	12,900		
95-11/ 5 ft	2	1	12/1/1998 10:07	0.002	0.0	0.0	0.0	0.0	7,870		
95-11/ 5 ft	2	1	12/31/1998 9:29	-0.035	1.5	0.0	0.0	0.0	8,890		
95-11/ 5 ft	2	1	1/26/1999 9:53	-0.012	2.5	0.0	0.0	0.0	6,680		
95-11/ 5 ft	2	1	2/23/1999	0.000	--	--	--	--	--	Unable to pull sample from SGP 95-11	
95-11/ 5 ft	2	1	3/22/1999	--	--	--	--	--	--	Unable to pull sample from SGP 95-11; tubing full of dirt	
95-12/ 5 ft	2	1	11/5/1998 10:38	0.000	1.2	1.1	0.0	0.0	13,700		
95-12/ 5 ft	2	1	12/1/1998 9:47	0.000	0.0	0.0	0.0	0.0	8,260		

Table E-2. Carbon Tetrachloride Concentrations Monitored at the 216-Z-9 Wellfield During Nonoperation of the SVE System, October 1998 Through September 1999. (9 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date Time	Differential Pressure (kPa)	CCl ₄ (ppmv)	CHCl ₃ (ppmv)	MEK (ppmv)	CH ₂ Cl ₂ (ppmv)	Water (ppmv)	Comment	CO ₂ (%)
95-12/ 5 ft	2	1	12/31/1998 9:14	-0.037	1.2	0.0	0.0	0.0	8,760		
95-12/ 5 ft	2	1	1/26/1999 9:37	-0.012	1.3	0.0	0.0	0.0	6,580		
95-12/ 5 ft	2	1	2/23/1999 10:17	-0.002	1.2	0.0	0.0	0.0	8,400		
95-12/ 5 ft	2	1	3/22/1999	--	--	--	--	--	--	SGP 95-12 destroyed	
95-14/ 5 ft	2	1	7/30/1999	--	--	--	--	--	--	Pump failure	
95-14/ 5 ft	2	1	9/14/1999	--	--	--	--	--	--	Unable to locate sample point	
CPT-16/ 10 ft	3	2	11/5/1998 11:34	0.000	1.5	0.0	0.0	0.0	13,000		
CPT-16/ 10 ft	3	2	12/1/1998 10:59	0.000	0.0	0.0	0.0	0.0	8,500		
CPT-16/ 10 ft	3	2	12/31/1998 10:21	-0.007	0.0	0.0	0.0	0.0	10,300		
CPT-16/ 10 ft	3	2	1/26/1999 10:40	-0.022	0.0	0.0	0.0	0.0	7,880		
CPT-16/ 10 ft	3	2	2/23/1999 11:43	-0.002	1.0	0.0	0.0	0.0	9,590		
CPT-16/ 10 ft	3	2	3/22/1999 11:17	0.017	0.0	0.0	0.0	0.0	11,600		
CPT-16/ 10 ft	3	2	7/30/1999	--	--	--	--	--	--	Pump failure	
CPT-16/ 10 ft	3	2	9/14/1999 12:09	0.025	0.0	0.0	1.0	1.0	12400		0.1
CPT-16/ 10 ft	3	2	9/28/1999 11:57	0.007	0.0	0.0	0.0	0.0	12,400		
CPT-17/ 10 ft	3	2	11/5/1998 10:31	0.000	3.2	0.0	0.0	0.0	13,000		
CPT-17/ 10 ft	3	2	12/1/1998 9:41	-0.005	1.7	0.0	0.0	0.0	8,110		
CPT-17/ 10 ft	3	2	12/31/1998 9:10	0.000	3.2	0.0	0.0	0.0	8,770		
CPT-17/ 10 ft	3	2	1/26/1999 9:33	-0.012	3.7	0.0	0.0	0.0	6,510		
CPT-17/ 10 ft	3	2	2/23/1999 10:13	-0.007	3.4	0.0	0.0	0.0	8,550		
CPT-17/ 10 ft	3	2	3/23/1999 10:28	0.007	5.1	0.0	0.0	0.0	13,700		
CPT-17/ 10 ft	3	2	7/30/1999 8:08	0.002	2.1	0.0	0.0	0.0	16,900		
CPT-17/ 10 ft	3	2	9/14/1999 9:35	0.007	2.6	0.0	0.0	1.7	9,550		0.2
CPT-17/ 10 ft	3	2	9/28/1999 9:22	-0.002	2.3	0.0	0.0	1.1	6,560		
CPT-18/ 15 ft	5	2	11/5/1998 10:44	0.000	0.0	0.0	0.0	0.0	13,300		
CPT-18/ 15 ft	5	2	12/1/1998 10:03	0.000	0.0	0.0	0.0	0.0	8,080		

Appendix E – FY 1999 Soil Vapor Monitoring Data

Sample Location	Depth (m bgs)	Zone	Sample Date Time	Differential Pressure (kPa)	CCl ₄ (ppmv)	CHCl ₃ (ppmv)	MEK (ppmv)	CH ₂ Cl ₂ (ppmv)	Water (ppmv)	Comment	CO ₂ (%)
CPT-18/ 15 ft	5	2	12/31/1998 9:25	0.002	5.0	0.0	0.0	0.0	8,910		
CPT-18/ 15 ft	5	2	1/26/1999 9:48	-0.020	4.5	0.0	0.0	0.0	6,560		
CPT-18/ 15 ft	5	2	2/23/1999 10:29	-0.007	4.6	0.0	0.0	0.0	8,400		
CPT-18/ 15 ft	5	2	3/23/1999 9:23	0.002	3.3	0.0	0.0	0.0	10,100		
CPT-18/ 15 ft	5	2	7/30/1999 8:23	0.005	1.3	0.0	0.0	0.0	16,900		
CPT-18/ 15 ft	5	2	9/14/1999 9:53	0.007	3.5	0.0	0.0	0.0	9,210		0.0
CPT-18/ 15 ft	5	2	9/14/1999 9:53	0.000	3.4	0.0	0.0	0.0	9,140	Duplicate	0.0
CPT-18/ 15 ft	5	2	9/28/1999 9:52	0.000	0.0	0.0	0.0	1.1	6,890		
CPT-21A/ 45 ft	14	2	7/30/1999 7:51	-0.027	51.7	1.2	0.0	0.0	14,900		
CPT-21A/ 45 ft	14	2	9/14/1999 9:24	-0.007	56.6	0.0	0.0	3.0	8,770		0.0
CPT-21A/ 45 ft	14	2	9/28/1999 9:12	-0.045	42.0	0.0	0.0	1.7	6,120		
W15-220SST/ 52 ft	16	2	7/30/1999	--	--	--	--	--	--	Pump failure	
W15-220SST/ 52 ft	16	2	9/14/1999 11:51	0.045	1.6	0.0	0.0	1.5	10,100		0.0
W15-220SST/ 52 ft	16	2	9/28/1999 11:34	0.032	1.3	0.0	0.0	0.0	9,790		
CPT-28/ 60 ft	18	2	7/30/1999 7:30	-0.057	3.7	0.0	0.0	0.0	13,600		
CPT-28/ 60 ft	18	2	9/14/1999 9:12	-0.002	2.1	0.0	0.0	0.0	8,673		0.0
CPT-28/ 60 ft	18	2	9/28/1999 8:59	0.012	1.8	0.0	0.0	0.0	5,920		
CPT-9A/ 60 ft	18	2	7/30/1999	--	--	--	--	--	--	Pump failure	
CPT-9A/ 60 ft	18	2	9/14/1999 12:28	0.070	43.9	0.0	0.0	1.1	15,000		0.0
CPT-9A/ 60 ft	18	2	9/28/1999 12:03	0.037	44.0	0.0	0.0	3.0	14,400		
CPT-24/ 70 ft	21	2	7/30/1999	--	--	--	--	--	--	Pump failure	
CPT-24/ 70 ft	21	2	9/14/1999 10:45	0.030	3.6	0.0	0.0	1.3	9,350		0.0
CPT-24/ 70 ft	21	2	9/28/1999 10:44	-0.030	2.3	0.0	0.0	5.0	8,140		
W15-219SST/ 70 ft	21	2	7/30/1999	--	--	--	--	--	--	Pump failure	
W15-219SST/ 70 ft	21	2	9/14/1999 10:05	0.030	7.6	0.0	0.0	11.2	8,763		0.0
W15-219SST/ 70 ft	21	2	9/28/1999 10:08	-0.035	2.8	0.0	0.0	10.0	6,540		

Table E-2. Carbon Tetrachloride Concentrations Monitored at the 216-Z-9 Wellfield During Nonoperation of the SVE System, October 1998 Through September 1999. (9 Pages)

Table E-2. Carbon Tetrachloride Concentrations Monitored at the 216-Z-9 Wellfield During Nonoperation of the SVE System, October 1998 Through September 1999. (9 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date Time	Differential Pressure (kPa)	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment	CO2 (%)
W15-82/ 83 ft	25	2	11/5/1998 11:14	0.037	46.4	1.7	2.7	62.6	13,100		
W15-82/ 83 ft	25	2	11/5/1998 11:14	0.037	46.3	1.5	2.8	62.6	13,300	Duplicate	
W15-82/ 83 ft	25	2	12/1/1998 10:45	-0.082	19.2	0.0	2.8	58.0	8,420		
W15-82/ 83 ft	25	2	12/31/1998 10:08	-0.007	23.1	0.0	2.5	58.5	10,400		
W15-82/ 83 ft	25	2	1/26/1999 10:28	-0.249	22.1	0.0	1.4	32.0	7,840	Opened for vertical velocity profiling 1/6-1/19	
W15-82/ 83 ft	25	2	1/26/1999 10:28	-0.249	22.0	0.0	1.4	32.8	7,790	Duplicate; opened for vertical velocity profiling 1/6-1/19	
W15-82/ 83 ft	25	2	2/23/1999 11:32	-0.055	24.6	0.0	1.6	37.1	10,900		
W15-82/ 83 ft	25	2	3/22/1999 10:43	0.125	18.5	1.1	1.3	32.1	10,800		
W15-82/ 83 ft	25	2	7/30/1999	--	--	--	--	--	--	Pump failure	
W15-82/ 83 ft	25	2	9/14/1999 11:21	0.077	42.5	2.9	2.0	31.2	9,680		0.0
W15-82/ 83 ft	25	2	9/28/1999 11:25	-0.015	38.1	2.3	1.5	27.0	10,500		
CPT-21A/ 86 ft	26	2	11/5/1998 10:23	-0.015	126.0	1.8	0.0	0.0	13,200		
CPT-21A/ 86 ft	26	2	12/1/1998 9:32	-0.194	74.6	0.0	0.0	1.2	8,010		
CPT-21A/ 86 ft	26	2	12/31/1998 9:04	-0.042	140.0	1.1	0.0	1.6	8,690		
CPT-21A/ 86 ft	26	2	1/26/1999 9:27	-0.202	148.0	1.1	0.0	1.5	6,430		
CPT-21A/ 86 ft	26	2	2/23/1999 10:07	0.037	142.0	0.0	0.0	1.7	8,460		
CPT-21A/ 86 ft	26	2	3/23/1999 10:07	-0.102	119.0	1.1	0.0	1.0	12,600		
CPT-21A/ 86 ft	26	2	4/26/1999 11:43	-0.005	90.9	0.0	0.0	0.0	9,390		
CPT-21A/ 86 ft	26	2	5/25/1999 11:38	-0.120	61.9	0.0	0.0	0.0	22,700		
CPT-21A/ 86 ft	26	2	6/28/1999 10:17	-0.010	82.0	0.0	0.0	0.0	18,900		
CPT-21A/ 86 ft	26	2	7/30/1999 8:00	-0.070	66.6	0.0	0.0	0.0	15,500		
CPT-21A/ 86 ft	26	2	9/14/1999 9:28	-0.020	12.6	0.0	0.0	3.9	9,320		0.0
CPT-21A/ 86 ft	26	2	9/28/1999 9:16	-0.100	123.0	0.0	0.0	2.1	6,370		
W15-95/ 86 ft	26	2	11/5/1998 11:05	0.040	39.4	0.0	0.0	1.2	13,200		
W15-95/ 86 ft	26	2	12/1/1998 10:37	-0.125	25.4	0.0	0.0	2.3	8,230		

Table E-2. Carbon Tetrachloride Concentrations Monitored at the 216-Z-9 Wellfield During Nonoperation of the SVE System, October 1998 Through September 1999. (9 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date Time	Differential Pressure (kPa)	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment	CO2 (%)
W15-95/ 86 ft	26	2	12/31/1998 10:02	-0.339	37.3	0.0	0.0	2.5	9,950		
W15-95/ 86 ft	26	2	1/26/1999 10:22	-0.237	28.1	0.0	0.0	2.9	7,470		
W15-95/ 86 ft	26	2	2/23/1999 11:05	-0.052	30.6	0.0	0.0	2.9	10,100		
W15-95/ 86 ft	26	2	3/22/1999 11:11	-0.092	27.1	1.3	0.0	2.6	11,700		
W15-95/ 86 ft	26	2	7/30/1999	--	--	--	--	--	--	Pump failure	
W15-95/ 86 ft	26	2	9/14/1999 11:14	-0.379	8.3	0.0	1.7	12.5	9,560		0.0
W15-95/ 86 ft	26	2	9/28/1999 11:18	-1.390	7.6	0.0	0.0	9.3	9,610		
W15-218SST/ 86 ft	26	2	7/30/1999	--	--	--	--	--	--	Pump failure	
W15-218SST/ 86 ft	26	2	9/14/1999	0.194	--	--	--	--	--	Unable to pull sample due to low flow	
W15-218SST/ 86 ft	26	2	9/28/1999	0.050	--	--	--	--	--	Did not complete collection--low flow	
CPT-28/ 87 ft	27	2	11/5/1998 9:49	-0.002	184.0	2.7	0.0	0.0	13,200		
CPT-28/ 87 ft	27	2	12/1/1998 9:25	-0.194	65.2	0.0	0.0	1.3	7,940		
CPT-28/ 87 ft	27	2	12/31/1998 8:57	-0.030	203.0	1.5	0.0	2.0	8,720		
CPT-28/ 87 ft	27	2	1/26/1999 9:19	-0.202	170.0	1.2	0.0	1.3	6,380		
CPT-28/ 87 ft	27	2	2/23/1999 10:00	0.037	156.0	1.0	0.0	1.8	8,350		
CPT-28/ 87 ft	27	2	3/22/1999 10:08	0.095	176.0	2.0	0.0	0.0	9,630		
CPT-28/ 87 ft	27	2	4/26/1999 11:37	0.007	98.6	0.0	0.0	1.1	9,070		
CPT-28/ 87 ft	27	2	5/25/1999 11:31	-0.172	53.4	0.0	0.0	1.1	22,800		
CPT-28/ 87 ft	27	2	6/28/1999 10:04	-0.010	93.1	0.0	0.0	0.0	16,800		
CPT-28/ 87 ft	27	2	7/30/1999 7:37	-0.090	49.3	0.0	0.0	0.0	13,700		
CPT-28/ 87 ft	27	2	9/14/1999 9:16	-0.030	151.0	0.0	0.0	3.5	8,990		0.0
CPT-28/ 87 ft	27	2	9/28/1999 9:03	-0.107	105.0	0.0	0.0	2.1	5,900		
CPT-9A/ 91 ft	28	2	11/5/1998 11:42	0.015	39.0	0.0	0.0	0.0	12,800		
CPT-9A/ 91 ft	28	2	12/1/1998 11:06	-0.037	38.6	0.0	0.0	1.5	7,960		
CPT-9A/ 91 ft	28	2	12/31/1998 10:27	-0.012	12.4	0.0	0.0	0.0	11,300		

Table E-2. Carbon Tetrachloride Concentrations Monitored at the 216-Z-9 Wellfield During Nonoperation of the SVE System, October 1998 Through September 1999. (9 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date Time	Differential Pressure (kPa)	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment	CO2 (%)
CPT-9A/ 91 ft	28	2	12/31/1998 10:27	-0.012	12.5	0.0	0.0	0.0	11,400	Duplicate	
CPT-9A/ 91 ft	28	2	1/26/1999 10:47	-0.100	39.8	0.0	0.0	1.1	8,220		
CPT-9A/ 91 ft	28	2	2/23/1999 11:50	0.037	32.2	0.0	0.0	0.0	9,670		
CPT-9A/ 91 ft	28	2	2/23/1999 11:50	0.037	32.5	0.0	0.0	1.1	9,710	Duplicate	
CPT-9A/ 91 ft	28	2	3/22/1999 11:44	0.107	37.7	0.0	0.0	0.0	11,800		
CPT-9A/ 91 ft	28	2	4/26/1999 12:34	0.020	37.5	0.0	0.0	1.0	7,430		
CPT-9A/ 91 ft	28	2	4/26/1999 12:34	0.020	37.5	0.0	0.0	0.0	7,430	Duplicate	
CPT-9A/ 91 ft	28	2	5/25/1999 11:44	-0.030	32.0	0.0	0.0	0.0	19,300		
CPT-9A/ 91 ft	28	2	6/28/1999 10:31	0.010	14.2	0.0	0.0	0.0	12,400		
CPT-9A/ 91 ft	28	2	7/30/1999	--	--	--	--	--	--	Pump failure	
CPT-9A/ 91 ft	28	2	9/14/1999 12:32	0.032	72.3	0.0	0.0	6.1	11,900		0.0
CPT-9A/ 91 ft	28	2	9/28/1999 12:07	0.012	17.3	0.0	0.0	0.0	9,170		
W15-217/ 114 ft	35	3	11/5/1998	--	--	--	--	--	--	Not in service	
W15-217/ 114 ft	35	3	12/1/1998 9:53	-0.207	26.8	0.0	0.0	0.0	8,200		
W15-217/ 114 ft	35	3	12/31/1998 9:20	-0.040	339.0	3.2	0.0	0.0	8,990		
W15-217/ 114 ft	35	3	1/26/1999 9:42	-0.187	348.0	3.2	0.0	1.0	6,810	Opened for vertical velocity profiling 1/6-1/19	
W15-217/ 114 ft	35	3	2/23/1999 10:22	0.047	418.0	3.5	0.0	1.4	9,030		
W15-217/ 114 ft	35	3	3/23/1999 8:45	-0.130	561.0	5.2	0.0	1.7	10,200		
W15-217/ 114 ft	35	3	7/30/1999 8:17	-0.120	68.6	1.2	0.0	4.8	13,700		
W15-217/ 114 ft	35	3	9/14/1999 9:46	-0.017	267.0	0.0	0.0	6.7	9,180		0.1
W15-217/ 114 ft	35	3	9/28/1999 9:42	-0.219	26.3	0.0	0.0	5.9	7,360		
CPT-24/ 118 ft	36	3	11/5/1998 10:57	0.000	37.1	2.1	0.0	0.0	13,100		
CPT-24/ 118 ft	36	3	12/1/1998 10:15	-0.271	37.3	1.3	0.0	1.5	8,070		
CPT-24/ 118 ft	36	3	12/31/1998 9:35	-0.042	33.5	0.0	0.0	0.0	9,210		
CPT-24/ 118 ft	36	3	1/26/1999 10:00	-0.319	20.9	0.0	0.0	0.0	6,810		
CPT-24/ 118 ft	36	3	2/23/1999 10:46	0.035	21.3	0.0	0.0	0.0	8,870		

Table E-2. Carbon Tetrachloride Concentrations Monitored at the 216-Z-9 Wellfield During Nonoperation of the SVE System, October 1998 Through September 1999. (9 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date Time	Differential Pressure (kPa)	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment	CO2 (%)
CPT-24/ 118 ft	36	3	3/22/1999 11:33	0.222	25.6	1.3	0.0	0.0	12,100		
CPT-24/ 118 ft	36	3	7/30/1999	--	--	--	--	--	--	Pump failure	
CPT-24/ 118 ft	36	3	9/14/1999 10:51	0.017	33.3	0.0	1.1	4.3	9,740		0.0
CPT-24/ 118 ft	36	3	9/28/1999 10:50	-0.107	11.4	0.0	0.0	1.4	8,050		
W15-220SST/ 118 ft	36	4	7/30/1999	--	--	--	--	--	--	Pump failure	
W15-220SST/ 118 ft	36	4	9/14/1999 11:57	0.209	35.9	0.0	0.0	2.7	10,200		0.0
W15-220SST/ 118 ft	36	4	9/28/1999 11:37	0.483	17.1	0.0	0.0	1.1	9,830		
W15-219SST/ 130 ft	40	4	7/30/1999	--	--	--	--	--	--	Pump failure	
W15-219SST/ 130 ft	40	4	9/14/1999 10:16	0.142	46.5	0.0	0.0	7.3	8,600		0.0
W15-219SST/ 130 ft	40	4	9/28/1999	-0.386	--	--	--	--	--	Did not complete collection--low flow	
W15-219SST/ 155 ft	47	5	7/30/1999	--	--	--	--	--	--	Pump failure	
W15-219SST/ 155 ft	47	5	9/14/1999 10:23	0.144	24.2	0.0	0.0	7.2	9,050		0.0
W15-219SST/ 155 ft	47	5	9/28/1999	-0.553	--	--	--	--	--	Did not complete collection--low flow	
W15-9L/ 176 ft	54	6	11/5/1998	--	--	--	--	--	--	Not in service	
W15-9L/ 176 ft	54	6	12/1/1998 10:30	-0.448	14.6	0.0	0.0	1.3	8,120		
W15-9L/ 176 ft	54	6	12/1/1998 10:30	-0.448	14.5	0.0	0.0	1.1	8,170	Duplicate	
W15-9L/ 176 ft	54	6	12/31/1998 9:55	-0.042	14.9	0.0	0.0	1.5	9,940		
W15-9L/ 176 ft	54	6	1/26/1999 10:15	-0.162	14.1	0.0	0.0	1.3	7,360		
W15-9L/ 176 ft	54	6	2/23/1999 10:58	0.060	14.9	0.0	0.0	1.4	9,210		
W15-9L/ 176 ft	54	6	3/22/1999 11:06	-0.035	0.0	1.3	0.0	0.0	11,600	W15-9L tubing inadvertently cut and dropped down well	
W15-9L/ 176 ft	54	6	7/30/1999	--	--	--	--	--	--	Pump failure	
W15-9L/ 176 ft	54	6	9/14/1999 11:06	0.080	10.3	0.0	1.0	3.4	9,930		0.0
W15-9L/ 176 ft	54	6	9/28/1999 11:08	-0.075	1.1	0.0	0.0	1.0	6,340		
W15-6L/ 182 ft	55	6	11/5/1998	--	--	--	--	--	--	Not in service	

Table E-2. Carbon Tetrachloride Concentrations Monitored at the 216-Z-9 Wellfield During Nonoperation of the SVE System, October 1998 Through September 1999. (9 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date Time	Differential Pressure (kPa)	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment	CO2 (%)
W15-6L/ 182 ft	55	6	12/1/1998 10:22	-0.471	0.0	1.2	0.0	0.0	8,160		
W15-6L/ 182 ft	55	6	12/31/1998 9:47	0.311	1.3	0.0	0.0	0.0	10,100		
W15-6L/ 182 ft	55	6	1/26/1999 10:07	-0.007	1.1	0.0	0.0	0.0	7,260		
W15-6L/ 182 ft	55	6	2/23/1999 10:52	0.080	1.2	1.2	0.0	0.0	9,500		
W15-6L/ 182 ft	55	6	3/22/1999 11:22	0.002	0.0	2.0	0.0	0.0	11,800	W15-6L tubing separated at first splice (~50 ft tubing in well), impossible to determine time of separation	
W15-220SST/ 185 ft	56	5	7/30/1999	--	--	--	--	--	--	Pump failure	
W15-220SST/ 185 ft	56	5	9/14/1999 12:01	0.207	13.4	0.0	0.0	2.9	9,770		0.0
W15-220SST/ 185 ft	56	5	9/28/1999 11:42	-0.471	8.4	0.0	0.0	2.4	9,940		
W15-220SST/ 185 ft	56	5	9/28/1999 11:42	-0.471	8.3	0.0	0.0	1.8	9,900	Duplicate	

Note: Concentrations recorded in this table as 0.0 ppmv were measured as <1.0 ppmv.

-- = no data

bgs = below ground surface

CCl4 = carbon tetrachloride

CH2Cl2 = methylene chloride

CHCl3 = chloroform

CO2 = carbon dioxide

MEK = methylethyl ketone

ppmv = parts per million by volume

**Table E-3. Carbon Tetrachloride Concentration Standard Analyses,
October 1998 Through September 1999.**

Carbon Tetrachloride Concentration Standard (ppmv)	Carbon Tetrachloride Concentration Analyzed (ppmv)	Date Analyzed	Time Analyzed	B&K Serial Number
25.5	25.1	01/26/99	11:04	1715232
25.5	25.5	01/26/99	12:08	1715232
25.5	25.1	02/23/99	12:26	1715232
25.5	25.6	02/23/99	13:26	1715232
25.5	23.9	03/22/99	12:17	1715232
25.5	24.9	03/22/99	13:07	1715232
25.5	25.2	03/23/99	10:46	1715232
25.5	28.7	03/23/99	10:56	1715232
25.5	25.4	04/26/99	12:52	1715232
25.5	26.8	04/26/99	13:52	1715232
25.5	25.5	05/25/99	11:56	1715232
25.5	26.6	05/25/99	12:54	1715232
25.5	25.6	06/28/99	10:43	1715232
25.5	26.6	06/28/99	11:41	1715232
25.5	25.2	07/30/99	9:55	1715232
25.5	25.7	07/30/99	10:17	1715232
25.5	26.4	09/14/99	13:24	1747619
25.5	26.7	09/14/99	14:17	1747619
25.5	26.1	09/28/99	12:32	1747619
25.5	26.7	09/28/99	13:32	1747619
25.5	23.9	11/05/98	12:05	1715232
25.5	24.9	11/05/98	12:57	1715232
25.5	25.1	12/01/98	12:39	1715232
25.5	25.3	12/01/98	13:41	1715232
25.5	25.1	12/31/98	10:42	1715232
25.5	25.4	12/31/98	11:42	1715232

Appendix E – FY 1999 Soil Vapor Monitoring Data

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Table E-4. Blank Analyses^a, October 1998 Through September 1999.

Sample Location	Sample Date	Sample Time	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)
Blank	11/05/98	12:03	0.0	1.1	0.0	0.0	10,400
Blank	11/05/98	12:59	0.0	0.0	0.0	0.0	12,900
Blank	12/01/98	12:37	0.0	0.0	0.0	0.0	7,930
Blank	12/01/98	13:43	0.0	0.0	0.0	0.0	9,430
Blank	12/31/98	10:42	0.0	0.0	0.0	0.0	7,960
Blank	12/31/98	11:44	0.0	0.0	0.0	0.0	8,890
Blank	01/26/99	11:02	0.0	3.9	0.0	0.0	5,800
Blank	01/26/99	11:06	0.0	0.0	0.0	0.0	5,710
Blank	01/26/99	12:10	0.0	0.0	0.0	0.0	7,420
Blank	02/23/99	12:24	0.0	0.0	0.0	0.0	7,730
Blank	02/23/99	13:28	0.0	0.0	0.0	0.0	8,290
Blank	03/22/99	12:15	0.0	0.0	0.0	0.0	7,830
Blank	03/22/99	13:09	0.0	0.0	0.0	0.0	9,430
Blank	03/23/99	10:44	0.0	0.0	0.0	0.0	7,810
Blank	03/23/99	10:58	0.0	0.0	0.0	0.0	8,950
Blank	04/26/99	12:50	0.0	0.0	0.0	0.0	4,500
Blank	04/26/99	13:54	0.0	0.0	0.0	0.0	5,810
Blank	05/25/99	11:54	0.0	0.0	0.0	0.0	8,250
Blank	05/25/99	12:56	0.0	0.0	0.0	0.0	8,080
Blank	06/28/99	10:41	0.0	0.0	0.0	0.0	9,580
Blank	06/28/99	11:43	0.0	0.0	0.0	0.0	8,830
Blank	07/30/99	9:53	0.0	0.0	0.0	0.0	9,770
Blank	07/30/99	10:19	0.0	0.0	0.0	0.0	8,820
Blank	09/14/99	13:22	0.0	0.0	0.0	0.0	9,370
Blank	09/14/99	14:19	0.0	0.0	0.0	0.0	13,500
Blank	09/28/99	12:30	0.0	0.0	0.0	0.0	6,330
Blank	09/28/99	13:34	0.0	0.0	0.0	0.0	6,440

Note: Concentrations recorded in this table as 0.0 ppmv were measured as <1.0 ppmv.

^a Analyses of the vapor headspace in blank samples of deionized water.

CCl4 = carbon tetrachloride

CHCl3 = chloroform

MEK = methylethyl ketone

CH2Cl2 = methylene chloride

APPENDIX F

FISCAL YEAR 2000 SOIL VAPOR MONITORING DATA

**Table F-1. Carbon Tetrachloride Concentrations Monitored at the 216-Z-1A/Z-18/Z-12 Wellfield
During Nonoperation of the SVE System, October 1999 Through September 2000. (4 Pages)**

Sample Location	Depth (m bgs)	Zone	Sample Date/Time	Differential Pressure (kPa)	CCl ₄ (ppmv)	CHCl ₃ (ppmv)	MEK (ppmv)	CH ₂ Cl ₂ (ppmv)	Water (ppmv)	Comment
CPT-32/ 25 ft	8	2	10/26/99 7:47	-0.030	0.0	0.0	0.0	0.0	8,330	
CPT-32/ 25 ft	8	2	11/30/99 10:36	0.020	0.0	0.0	0.0	1.3	9,030	
CPT-32/ 25 ft	8	2	12/29/99 9:00	-0.020	1.5	0.0	0.0	0.0	6,520	
CPT-32/ 25 ft	8	2	1/25/00 8:04	--	3.8	0.0	0.0	0.0	7,910	Differential pressure transducer not functional.
CPT-32/ 25 ft	8	2	3/7/00 8:56	--	9.4	0.0	0.0	1.2	7,350	Differential pressure transducer not functional.
CPT-32/ 25 ft	8	2	6/2/00 8:45	0.000	8.6	0.0	0.0	1.6	11,200	
CPT-32/ 25 ft	8	2	6/27/00 8:23	0.000	7.2	0.0	0.0	2.0	10,300	
CPT-32/ 25 ft	8	2	7/24/00 8:57	0.030	8.1	0.0	0.0	1.4	10,200	
CPT-32/ 25 ft	8	2	8/29/00 8:04	-0.020	6.6	0.0	0.0	1.4	10,000	
CPT-32/ 25 ft	8	2	9/25/00 8:29	-0.010	6.4	0.0	0.0	0.0	7,370	
CPT-30/ 28 ft	9	2	10/26/99 7:40	-0.020	0.0	0.0	0.0	0.0	8,010	
CPT-30/ 28 ft	9	2	11/30/99 10:00	-0.060	1.0	0.0	0.0	2.5	8,540	
CPT-30/ 28 ft	9	2	12/29/99 8:55	-0.020	1.4	0.0	0.0	1.2	6,500	
CPT-30/ 28 ft	9	2	1/25/00 7:59	--	0.0	0.0	0.0	0.0	7,920	Differential pressure transducer not functional.
CPT-30/ 28 ft	9	2	3/7/00 8:53	--	0.0	0.0	0.0	0.0	7,620	Differential pressure transducer not functional.
CPT-30/ 28 ft	9	2	6/2/00 8:14	0.000	0.0	0.0	0.0	1.5	9,890	
CPT-30/ 28 ft	9	2	6/27/00 8:15	0.000	0.0	0.0	0.0	1.9	10,600	
CPT-30/ 28 ft	9	2	7/24/00 9:02	0.020	0.0	0.0	0.0	1.2	10,500	
CPT-30/ 28 ft	9	2	8/29/00 8:00	-0.040	0.0	0.0	0.0	1.4	9,880	
CPT-30/ 28 ft	9	2	9/25/00 8:34	-0.030	1.0	0.0	0.0	0.0	7,390	
CPT-13A/ 30 ft	9	2	10/26/99 8:07	-0.010	0.0	0.0	0.0	0.0	8,660	
CPT-13A/ 30 ft	9	2	11/30/99 12:08	0.100	0.0	0.0	0.0	0.0	11,100	
CPT-13A/ 30 ft	9	2	12/29/99 9:23	-0.030	1.6	0.0	0.0	0.0	7,130	
CPT-13A/ 30 ft	9	2	1/25/00 8:37	--	1.1	0.0	0.0	0.0	8,360	Differential pressure transducer not functional.
CPT-13A/ 30 ft	9	2	3/7/00 9:12	--	2.1	0.0	0.0	0.0	8,400	Differential pressure transducer not functional.
CPT-13A/ 30 ft	9	2	6/2/00 9:06	0.610	2.5	0.0	0.0	0.0	12,500	
CPT-13A/ 30ft	9	2	6/27/00 8:53	0.000	3.4	0.0	0.0	1.2	10,500	
CPT-13A/ 30 ft	9	2	6/27/00 8:53	0.000	3.3	0.0	0.0	0.0	10,400	Duplicate
CPT-13A/ 30 ft	9	2	7/24/00 9:18	0.060	2.5	0.0	0.0	1.1	10,400	

**Table F-1. Carbon Tetrachloride Concentrations Monitored at the 216-Z-1A/Z-18/Z-12 Wellfield
During Nonoperation of the SVE System, October 1999 Through September 2000. (4 Pages)**

Sample Location	Depth (m bgs)	Zone	Sample Date/Time	Differential Pressure (kPa)	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment
CPT-13A/ 30 ft	9	2	8/29/00 8:40	0.020	3.4	0.0	0.0	0.0	10,700	
CPT-13A/ 30 ft	9	2	9/25/00 9:00	-0.020	2.6	0.0	0.0	0.0	7,970	
CPT-7A/ 32 ft	10	2	10/26/99 8:37	-0.030	2.3	0.0	0.0	0.0	9,430	
CPT-7A/ 32 ft	10	2	11/30/99 12:15	-0.450	1.9	0.0	0.0	0.0	11,000	
CPT-7A/ 32 ft	10	2	12/29/99 9:31	-0.020	2.8	0.0	0.0	0.0	7,170	
CPT-7A/ 32 ft	10	2	1/25/00 8:42	--	2.3	0.0	0.0	0.0	8,490	Differential pressure transducer not functional.
CPT-7A/ 32 ft	10	2	3/7/00 9:24	--	4.4	0.0	0.0	0.0	9,030	Differential pressure transducer not functional.
CPT-7A/ 32 ft	10	2	6/2/00 10:21	0.030	4.7	0.0	0.0	0.0	16,400	
CPT-7A/ 32 ft	10	2	6/27/00 9:04	-0.010	6.2	0.0	0.0	1.7	11,300	
CPT-7A/ 32 ft	10	2	7/24/00 9:29	0.050	3.9	0.0	0.0	1.1	11,400	
CPT-7A/ 32 ft	10	2	8/29/00 9:00	0.040	4.3	0.0	0.0	1.2	10,900	
CPT-7A/ 32 ft	10	2	9/25/00 9:12	-0.030	3.9	0.0	0.0	0.0	8,910	
CPT-1A/ 35 ft	11	2	10/26/99 7:34	-0.040	2.5	0.0	0.0	0.0	7,490	
CPT-1A/ 35 ft	11	2	11/30/99 9:30	-0.070	3.1	0.0	0.0	1.9	8,710	
CPT-1A/ 35 ft	11	2	12/29/99 8:37	-0.010	2.8	0.0	0.0	1.9	6,610	
CPT-1A/ 35 ft	11	2	1/25/00 7:52	--	4.1	0.0	0.0	1.1	7,830	Differential pressure transducer not functional.
CPT-1A/ 35 ft	11	2	3/7/00 8:46	--	3.3	0.0	0.0	0.0	7,790	Differential pressure transducer not functional.
CPT-1A/ 35 ft	11	2	6/2/00 8:03	0.000	4.2	0.0	0.0	1.8	10,600	
CPT-1A/ 35 ft	11	2	6/27/00 8:06	-0.020	3.7	0.0	0.0	2.4	10,100	
CPT-1A/ 35 ft	11	2	7/24/00 8:39	0.010	3.7	0.0	0.0	1.5	9,770	
CPT-1A/ 35 ft	11	2	8/29/00 7:56	-0.070	4.3	0.0	0.0	1.9	9,910	
CPT-1A/ 35 ft	11	2	9/25/00 8:11	-0.020	4.0	0.0	0.0	1.3	6,980	
W18-152/ 101 ft	31	2	10/26/99 7:30	-0.280	1.8	0.0	0.0	1.7	8,030	
W18-152/ 101 ft	31	2	11/30/99 9:46	-0.390	22.1	0.0	0.0	2.2	9,060	
W18-152/ 101 ft	31	2	12/29/99 8:31	0.180	24.7	0.0	0.0	1.3	6,570	
W18-152/ 101 ft	31	2	12/29/99 8:31	0.180	25.6	0.0	0.0	1.5	6,740	Duplicate
W18-152/ 101 ft	31	2	1/25/00 7:48	--	17.7	0.0	0.0	1.8	7,850	Differential pressure transducer not functional.
W18-152/ 101 ft	31	2	3/7/00 8:20	--	3.7	0.0	0.0	0.0	7,140	Differential pressure transducer not functional.
W18-152/ 101 ft	31	2	6/2/00 7:56	0.090	22.9	0.0	0.0	2.2	10,100	
W18-152/ 101 ft	31	2	6/27/00 8:04	-0.180	3.1	0.0	1.0	2.3	10,400	

**Table F-1. Carbon Tetrachloride Concentrations Monitored at the 216-Z-1A/Z-18/Z-12 Wellfield
During Nonoperation of the SVE System, October 1999 Through September 2000. (4 Pages)**

Sample Location	Depth (m bgs)	Zone	Sample Date/Time	Differential Pressure (kPa)	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment
W18-152/ 101 ft	31	2	7/24/00 8:16	-0.140	1.8	0.0	0.0	1.4	9,610	
W18-152/ 101 ft	31	2	8/29/00 7:51	0.080	13.7	0.0	0.0	2.2	9,760	
W18-152/ 101 ft	31	2	9/25/00 8:07	-0.100	5.2	0.0	0.0	1.3	7,310	
W18-167/ 106 ft	32	3	10/26/99 8:26	-0.340	88.8	0.0	0.0	7.1	8,760	
W18-167/ 106 ft	32	3	11/30/99 11:31	0.090	115.0	0.0	0.0	1.8	10,400	Sample bag torn during second A filter reading - no data
W18-167/ 106 ft	32	3	12/29/99 8:48	0.220	144.0	0.0	0.0	4.3	6,690	
W18-167/ 106 ft	32	3	1/25/00 9:10	--	109.0	0.0	0.0	4.4	8,280	Differential pressure transducer not functional. B filter value used for CCl4; A filter = 104 ppmv.
W18-167/ 106 ft	32	3	3/7/00 8:36	--	104.0	0.0	0.0	6.6	6,840	Differential pressure transducer not functional. B filter value used for CCl4; A filter = 90 ppmv.
W18-167/ 106 ft	32	3	6/2/00 8:27	0.000	248.0	2.6	0.0	3.3	19,600	
W18-167/ 106 ft	32	3	6/27/00 8:34	-0.030	227.0	2.0	1.2	6.3	11,400	
W18-167/ 106 ft	32	3	7/24/00 8:50	-0.200	216.0	1.4	1.1	8.8	10,600	
W18-167/ 106 ft	32	3	8/29/00 8:14	0.040	167.0	0.0	0.0	7.2	9,990	
W18-167/ 106 ft	32	3	9/25/00 8:22	-0.120	174.0	0.0	0.0	7.2	7,300	
W18-158L/ 120 ft	37	3	8/29/00 8:10	0.060	151.0	0.0	7.5	174.0	10,000	
W18-158L/ 120 ft	37	3	9/25/00 8:18	-0.130	141.0	0.0	6.8	165.0	7,240	
W18-158L/ 120 ft	37	3	10/26/99 8:23	-0.330	79.6	0.0	4.2	138.0	8,680	
W18-158L/ 120 ft	37	3	11/30/99 11:23	0.050	103.0	0.0	3.9	145.0	9,780	B filter value used for CCl4; A filter = 83.7 ppmv.
W18-158L/ 120 ft	37	3	12/29/99 8:45	0.240	134.0	0.0	4.6	170.0	6,620	
W18-158L/ 120 ft	37	3	1/25/00 9:00	--	132.0	0.0	4.8	173.0	8,030	Differential pressure transducer not functional. B filter value used for CCl4; A filter = 97.5 ppmv.
W18-158L/ 120 ft	37	3	3/7/00 8:30	--	152.0	0.0	6.6	165.0	7,120	Differential pressure transducer not functional.
W18-158L/ 120 ft	37	3	6/2/00 8:23	0.000	134.0	0.0	3.5	85.2	19,000	
W18-158L/ 120 ft	37	3	6/27/00 8:29	-0.230	196.0	0.0	6.8	141.0	10,600	
W18-158L/ 120 ft	37	3	7/24/00 8:46	-0.240	186.0	0.0	7.3	165.0	10,200	

Table F-1. Carbon Tetrachloride Concentrations Monitored at the 216-Z-1A/Z-18/Z-12 Wellfield During Nonoperation of the SVE System, October 1999 Through September 2000. (4 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date/Time	Differential Pressure (kPa)	CC14 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment
W18-158L/ 120 ft	37	3	7/24/00 8:46	-0.240	179.0	0.0	7.3	167.0	10,200	Duplicate
W18-249/ 130 ft	40	3	10/26/99 7:56	-0.380	74.8	0.0	0.0	1.9	8,280	
W18-249/ 130 ft	40	3	11/30/99 10:18	-0.360	132.0	0.0	0.0	0.0	9,070	B filter value used for CC14; A filter = 120 ppmv.
W18-249/ 130 ft	40	3	12/29/99 9:06	0.230	173.0	0.0	0.0	0.0	6,720	B filter value used for CC14; A filter = 163 ppmv.
W18-249/ 130 ft	40	3	1/25/00 8:15	--	149.0	0.0	0.0	0.0	7,870	Differential pressure transducer not functional. B filter value used for CC14; A filter = 131 ppmv.
W18-249/ 130 ft	40	3	3/7/00 9:05	--	60.0	0.0	0.0	1.3	7,690	Differential pressure transducer not functional.
W18-249/ 130 ft	40	3	6/2/00 8:59	0.160	176.0	2.2	0.0	1.8	21,700	
W18-249/ 130 ft	40	3	6/27/00 8:43	-0.230	137.0	0.0	1.3	3.6	10,500	
W18-249/ 130 ft	40	3	7/24/00 9:11	-0.170	78.3	0.0	0.0	2.5	10,300	
W18-249/ 130 ft	40	3	8/29/00 8:54	0.130	154.0	0.0	0.0	2.5	10,400	
W18-249/ 130 ft	40	3	9/25/00 8:40	-0.150	95.2	0.0	0.0	2.3	7,760	
W18-248/ 131 ft	40	3	10/26/99 8:13	-0.440	130.0	0.0	0.0	5.1	8,370	
W18-248/ 131 ft	40	3	11/30/99 12:21	0.300	96.7	0.0	0.0	2.2	11,400	
W18-248/ 131 ft	40	3	12/29/99 9:27	0.600	85.5	0.0	0.0	2.3	7,070	
W18-248/ 131 ft	40	3	1/25/00 9:26	--	110.0	0.0	0.0	2.0	8,310	Differential pressure transducer not functional. B filter value used for CC14; A filter = 106 ppmv.
W18-248/ 131 ft	40	3	3/7/00 9:17	--	130.0	0.0	0.0	3.9	7,610	Differential pressure transducer not functional. B filter value used for CC14; A filter = 129 ppmv.
W18-248/ 131 ft	40	3	6/2/00 10:14	0.420	183.0	1.7	0.0	4.7	12,600	
W18-248/ 131 ft	40	3	6/27/00 8:57	-0.440	186.0	0.0	1.1	6.2	11,400	
W18-248/ 131 ft	40	3	7/24/00 9:23	-0.230	170.0	0.0	1.0	4.8	10,300	

Appendix F – FY 2000 Soil Vapor Monitoring Data

Table F-1. Carbon Tetrachloride Concentrations Monitored at the 216-Z-1A/Z-18/Z-12 Wellfield During Nonoperation of the SVE System, October 1999 Through September 2000. (4 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date/Time	Differential Pressure (kPa)	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment
W18-248/ 131 ft	40	3	8/29/00 8:45	0.260	184.0	0.0	0.0	3.7	10,600	
W18-248/ 131 ft	40	3	9/25/00 9:07	-0.180	202.0	0.0	0.0	4.0	8,250	

Note: Concentrations recorded in this table as 0.0 ppmv were measured as <1.0 ppmv.

-- = no data

bgs = below ground surface

CCl4 = carbon tetrachloride

CH2Cl2 = methylene chloride

CHCl3 = chloroform

MEK = methyl ethyl ketone

ppmv = parts per million by volume

Table F-2. Carbon Tetrachloride Concentrations Monitored at the 216-Z-9 Wellfield During Nonoperation of the SVE System, October 1999 Through September 2000. (5 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date/Time	Differential Pressure (kPa)	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment
CPT-17/ 10 ft	3	2	10/26/99 9:10	-0.030	1.7	0.0	0.0	1.2	9,880	
CPT-17/ 10 ft	3	2	11/30/99 12:40	-0.210	3.1	0.0	0.0	2.2	11,400	
CPT-17/ 10ft	3	2	12/29/99 9:54	-0.010	2.6	0.0	0.0	1.5	6,820	
CPT-17/ 10 ft	3	2	1/25/00 10:09	--	2.9	0.0	0.0	2.1	9,640	Differential pressure transducer not functional.
CPT-17/ 10 ft	3	2	3/7/00 10:02	--	1.7	0.0	0.0	0.0	10,300	Differential pressure transducer not functional.
CPT-17/ 10 ft	3	2	6/2/00 10:40	-0.010	5.1	0.0	0.0	1.9	13,900	
CPT-17/ 10 ft	3	2	6/27/00 9:25	0.050	3.4	0.0	0.0	2.3	10,500	
CPT-17/ 10 ft	3	2	7/24/00 10:05	0.030	4.2	0.0	0.0	1.5	11,500	
CPT-17/ 10 ft	3	2	8/29/00 9:20	0.030	4.6	0.0	0.0	1.1	12,500	
CPT-17/ 10 ft	3	2	9/25/00 9:45	-0.010	4.4	0.0	0.0	0.0	10,200	
CPT-18/ 15 ft	5	2	10/26/99 9:25	-0.020	1.8	0.0	0.0	1.8	10,000	
CPT-18/ 15 ft	5	2	11/30/99 12:49	-0.010	1.6	0.0	0.0	1.8	11,100	
CPT-18/ 15 ft	5	2	11/30/99 12:49	-0.010	1.5	0.0	0.0	2.1	10,900	Duplicate
CPT-18/ 15ft	5	2	12/29/99 10:17	-0.010	4.3	0.0	0.0	2.0	7,870	
CPT-18/ 15 ft	5	2	1/25/00 10:36	--	2.8	0.0	0.0	0.0	10,800	Differential pressure transducer not functional.
CPT-18/ 15 ft	5	2	3/7/00 10:11	--	2.6	0.0	0.0	1.6	10,600	Differential pressure transducer not functional.
CPT-18/ 15 ft	5	2	6/2/00 10:50	0.020	5.2	0.0	0.0	1.6	13,200	
CPT-18/ 15 ft	5	2	6/27/00 9:55	0.120	3.8	0.0	0.0	2.0	13,900	
CPT-18/ 15 ft	5	2	7/24/00 10:13	0.040	2.0	0.0	0.0	1.5	11,700	
CPT-18/ 15 ft	5	2	8/29/00 9:42	0.040	4.1	0.0	0.0	1.2	11,600	
CPT-18/ 15 ft	5	2	9/25/00 9:54	0.000	3.2	0.0	0.0	0.0	9,960	
CPT-16/ 25 ft	8	2	10/26/99 10:01	-0.040	0.0	0.0	0.0	0.0	10,500	
CPT-16/ 25 ft	8	2	11/30/99 13:22	-0.020	0.0	0.0	0.0	0.0	11,900	
CPT-16/ 25 ft	8	2	12/29/99 10:48	0.000	0.0	0.0	0.0	0.0	7,810	
CPT-16/ 25 ft	8	2	1/25/00 10:56	--	0.0	0.0	0.0	0.0	9,930	Differential pressure transducer not functional.
CPT-16/ 25 ft	8	2	3/7/00 10:41	--	0.0	0.0	0.0	0.0	15,400	Differential pressure transducer not functional.
CPT-16/ 25 ft	8	2	6/2/00 11:20	0.060	0.0	0.0	0.0	0.0	12,500	
CPT-16/ 25 ft	8	2	6/27/00 10:17	0.070	1.6	0.0	0.0	0.0	11,400	
CPT-16/ 25 ft	8	2	7/24/00 10:34	0.050	1.4	0.0	0.0	0.0	11,800	

Table F-2. Carbon Tetrachloride Concentrations Monitored at the 216-Z-9 Wellfield During Nonoperation of the SVE System, October 1999 Through September 2000. (5 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date/Time	Differential Pressure (kPa)	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment
CPT-16/ 25 ft	8	2	8/29/00 10:36	0.070	1.8	0.0	0.0	0.0	12,200	
CPT-16/ 25 ft	8	2	9/25/00 10:21	0.000	1.7	0.0	0.0	0.0	11,700	
CPT-27/ 33 ft	10	2	10/26/99 9:56	-0.060	1.1	0.0	0.0	0.0	10,600	
CPT-27/ 33 ft	10	2	11/30/99 13:17	0.000	0.0	0.0	0.0	0.0	11,700	
CPT-27/ 33 ft	10	2	12/29/99 10:39	-0.030	1.2	0.0	0.0	0.0	7,020	
CPT-27/ 33 ft	10	2	1/25/00 10:52	--	1.2	0.0	0.0	1.0	10,100	Differential pressure transducer not functional.
CPT-27/ 33 ft	10	2	3/7/00 10:36	--	1.3	0.0	0.0	1.2	14,400	Differential pressure transducer not functional.
CPT-27/ 33 ft	10	2	6/2/00 11:13	0.020	1.6	0.0	0.0	1.2	12,500	
CPT-27/ 33 ft	10	2	6/27/00 10:13	0.060	1.3	0.0	0.0	1.5	12,300	
CPT-27/ 33 ft	10	2	7/24/00 10:30	0.060	1.2	0.0	0.0	0.0	12,600	
CPT-27/ 33 ft	10	2	8/29/00 10:27	0.070	1.8	0.0	0.0	0.0	12,800	
CPT-27/ 33 ft	10	2	9/25/00 10:12	0.010	1.6	0.0	0.0	0.0	11,800	
CPT-21A/ 45 ft	14	2	10/26/99 8:47	-0.170	50.3	0.0	0.0	1.4	9,420	
CPT-21A/ 45 ft	14	2	11/30/99 12:33	0.020	78.0	0.0	0.0	2.6	11,000	
CPT-21A/ 45 ft	14	2	12/29/99 9:47	-0.060	70.4	0.0	0.0	2.5	7,050	
CPT-21A/ 45 ft	14	2	1/25/00 9:50	--	81.6	0.0	0.0	1.9	9,270	Differential pressure transducer not functional.
CPT-21A/ 45 ft	14	2	3/7/00 9:45	--	54.0	0.0	0.0	2.8	10,000	Differential pressure transducer not functional.
CPT-21A/ 45 ft	14	2	6/2/00 10:33	0.100	94.0	0.0	0.0	4.8	13,600	
CPT-21A/ 45 ft	14	2	6/27/00 9:16	-0.180	88.7	0.0	1.1	5.6	11,200	
CPT-21A/ 45 ft	14	2	7/24/00 9:49	0.010	91.4	0.0	0.0	4.6	11,800	
CPT-21A/ 45 ft	14	2	8/29/00 9:08	0.170	122.0	0.0	0.0	4.9	11,400	
CPT-21A/ 45 ft	14	2	9/25/00 9:34	-0.100	96.4	0.0	0.0	4.1	9,990	
CPT-9A/ 60 ft	18	2	10/26/99 10:06	-0.150	32.9	0.0	0.0	2.7	11,000	
CPT-9A/ 60 ft	18	2	11/30/99 13:28	-0.050	39.3	0.0	0.0	3.6	12,200	
CPT-9A/ 60 ft	18	2	12/29/99 10:56	0.040	43.5	0.0	0.0	3.3	8,130	
CPT-9A/ 60 ft	18	2	1/25/00 11:00	--	38.1	0.0	0.0	2.7	9,830	Differential pressure transducer not functional.
CPT-9A/ 60 ft	18	2	3/7/00 10:47	--	33.2	0.0	0.0	2.5	14,300	Differential pressure transducer not functional.
CPT-9A/ 60 ft	18	2	6/2/00 11:25	0.140	43.9	0.0	0.0	3.8	15,400	
CPT-9A/ 60ft	18	2	6/27/00 10:24	-0.080	67.6	0.0	1.0	5.7	12,600	
CPT-9A/ 60 ft	18	2	7/24/00 10:43	0.140	40.3	0.0	0.0	3.4	12,300	

Table F-2. Carbon Tetrachloride Concentrations Monitored at the 216-Z-9 Wellfield During Nonoperation of the SVE System, October 1999 Through September 2000. (5 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date/Time	Differential Pressure (kPa)	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment
CPT-9A/ 60 ft	18	2	8/29/00 10:45	0.220	41.6	0.0	0.0	3.6	15,100	
CPT-9A/ 60 ft	18	2	9/25/00 10:26	-0.020	42.2	0.0	0.0	3.0	11,500	
CPT-9A/ 60 ft	18	2	9/25/00 10:26	-0.020	42.5	0.0	0.0	3.0	11,600	Duplicate
W15-82/ 83 ft	25	2	10/26/99 9:52	-0.540	35.7	2.6	1.2	29.3	10,100	
W15-82/ 83 ft	25	2	11/30/99 13:09	0.180	23.4	3.2	0.0	19.4	12,800	
W15-82/ 83 ft	25	2	12/29/99 10:35	0.240	21.2	3.2	0.0	23.9	8,030	
W15-82/ 83 ft	25	2	1/25/00 10:48	--	19.0	1.9	0.0	21.4	9,680	Differential pressure transducer not functional.
W15-82/ 83 ft	25	2	3/7/00 10:32	--	29.8	0.0	1.2	25.0	12,800	Differential pressure transducer not functional.
W15-82/ 83 ft	25	2	6/2/00 11:07	0.360	25.5	0.0	2.2	42.3	14,900	
W15-82/ 83 ft	25	2	6/27/00 10:10	-0.100	23.5	0.0	2.6	40.2	12,300	
W15-82/ 83 ft	25	2	7/24/00 10:27	0.040	25.5	0.0	2.2	45.6	11,200	
W15-82/ 83 ft	25	2	8/29/00 10:12	0.450	26.5	0.0	2.6	47.5	11,800	
W15-82/ 83 ft	25	2	8/29/00 10:12	0.450	26.5	0.0	2.7	48.0	11,700	Duplicate
W15-82/ 83 ft	25	2	9/25/00 10:16	-0.120	28.7	0.0	2.3	49.5	11,100	
CPT-21A/ 86 ft	26	2	10/26/99 8:51	-0.350	90.7	0.0	0.0	2.1	9,520	
CPT-21A/ 86 ft	26	2	10/26/99 8:51	-0.350	91.1	0.0	0.0	2.0	9,520	Duplicate
CPT-21A/ 86 ft	26	2	11/30/99 12:35	-0.020	133.0	0.0	0.0	2.9	11,400	B filter value used for CCl4; A filter = 126 ppmv.
CPT-21A/ 86 ft	26	2	12/29/99 9:51	0.000	123.0	0.0	0.0	2.1	7,030	B filter value used for CCl4; A filter = 116 ppmv.
CPT-21A/ 86 ft	26	2	1/25/00 9:54	--	141.0	0.0	0.0	2.2	9,360	Differential pressure transducer not functional.
CPT-21A/ 86 ft	26	2	3/7/00 9:53	--	113.0	0.0	0.0	1.7	9,600	Differential pressure transducer not functional. B filter value used for CCl4; A filter = 112 ppmv.
CPT-21A/ 86 ft	26	2	6/2/00 10:35	0.190	195.0	0.0	0.0	5.3	13,600	
CPT-21A/ 86 ft	26	2	6/27/00 9:19	-0.340	186.0	0.0	0.0	5.5	11,600	
CPT-21A/ 86 ft	26	2	7/24/00 9:52	-0.010	169.0	0.0	0.0	5.5	11,800	
CPT-21A/ 86 ft	26	2	8/29/00 9:11	0.250	189.0	0.0	0.0	5.7	11,600	
CPT-21A/ 86 ft	26	2	9/25/00 9:37	-0.170	175.0	0.0	0.0	4.6	10,200	
W15-95/ 86 ft	26	2	10/26/99 9:47	-0.010	9.0	0.0	0.0	9.5	9,860	
W15-95/ 86 ft	26	2	11/30/99 13:02	-0.140	11.2	0.0	0.0	8.4	12,400	

Table F-2. Carbon Tetrachloride Concentrations Monitored at the 216-Z-9 Wellfield During Nonoperation of the SVE System, October 1999 Through September 2000. (5 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date/Time	Differential Pressure (kPa)	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment
W15-95/ 86 ft	26	2	12/29/99 10:31	-1.350	12.0	0.0	0.0	8.8	7,950	
W15-95/ 86 ft	26	2	1/25/00 10:45	--	14.5	0.0	0.0	9.0	9,810	Differential pressure transducer not functional.
W15-95/ 86 ft	26	2	1/25/00 10:45	--	14.4	0.0	0.0	9.0	9,680	Duplicate
W15-95/ 86 ft	26	2	3/7/00 10:26	--	13.2	0.0	0.0	7.1	10,900	Differential pressure transducer not functional.
W15-95/ 86 ft	26	2	3/7/00 10:26	--	13.1	0.0	0.0	7.4	10,900	Duplicate
W15-95/ 86 ft	26	2	6/2/00 11:02	-1.500	21.2	0.0	1.2	10.4	13,500	
W15-95/ 86 ft	26	2	6/27/00 10:05	0.200	21.7	0.0	1.3	9.5	12,000	
W15-95/ 86 ft	26	2	7/24/00 10:23	-0.490	23.7	0.0	1.6	9.7	12,500	
W15-95/ 86 ft	26	2	8/29/00 10:03	-1.830	27.4	0.0	1.2	9.2	13,000	
W15-95/ 86 ft	26	2	9/25/00 10:07	-0.380	28.5	0.0	0.0	9.0	11,100	
CPT-28/ 87 ft	27	2	10/26/99 8:43	-0.360	104.0	0.0	0.0	2.4	9,450	B filter value used for CC14; A filter = 89.5 ppmv.
CPT-28/ 87 ft	27	2	11/30/99 12:27	0.070	170.0	0.0	0.0	3.2	11,200	B filter value used for CC14; A filter = 151 ppmv.
CPT-28/ 87 ft	27	2	12/29/99 9:43	-0.510	180.0	0.0	0.0	2.6	7,210	B filter value used for CC14; A filter = 154 ppmv.
CPT-28/ 87 ft	27	2	1/25/00 9:42	--	181.0	0.0	0.0	1.9	9,110	Differential pressure transducer not functional. B filter value used for CC14; A filter = 168 ppmv.
CPT-28/ 87 ft	27	2	3/7/00 9:32	--	69.7	0.0	0.0	2.5	8,860	Differential pressure transducer not functional.
CPT-28/ 87 ft	27	2	6/2/00 10:27	0.180	205.0	0.0	0.0	4.7	13,200	
CPT-28/ 87 ft	27	2	6/27/00 9:10	-0.320	165.0	0.0	0.0	5.4	11,800	B filter value used for CC14; A filter = 157 ppmv.
CPT-28/ 87 ft	27	2	7/24/00 9:42	0.010	174.0	0.0	0.0	4.1	11,400	
CPT-28/ 87 ft	27	2	8/29/00 9:04	0.250	214.0	0.0	0.0	4.7	12,000	
CPT-28/ 87 ft	27	2	9/25/00 9:20	-0.160	195.0	0.0	0.0	4.0	9,210	
W15-217/ 114 ft	35	3	10/26/99 9:21	-0.560	204.0	0.0	0.0	6.8	9,740	B filter value used for CC14; A filter = 176 ppmv.
W15-217/ 114 ft	35	3	11/30/99 12:44	0.220	317.0	0.0	0.0	4.5	12,300	B filter value used for CC14; A filter = 288 ppmv.

Table F-2. Carbon Tetrachloride Concentrations Monitored at the 216-Z-9 Wellfield During Nonoperation of the SVE System, October 1999 Through September 2000. (5 Pages)

Sample Location	Depth (m bgs)	Zone	Sample Date/Time	Differential Pressure (kPa)	CCl4 (ppmv)	CHCl3 (ppmv)	MEK (ppmv)	CH2Cl2 (ppmv)	Water (ppmv)	Comment
W15-217/ 114 ft	35	3	12/29/99 10:13	0.440	370.0	0.0	0.0	3.9	8,780	B filter value used for CC14; A filter = 333 ppmv.
W15-217/ 114 ft	35	3	1/25/00 10:20	--	400.0	0.0	0.0	4.8	9,610	Differential pressure transducer not functional. B filter value used for CC14; A filter = 366 ppmv.
W15-217/ 114 ft	35	3	3/7/00 10:06	--	92.0	1.0	0.0	4.5	9,720	Differential pressure transducer not functional.
W15-217/ 114 ft	35	3	6/2/00 10:45	0.460	442.0	2.7	0.0	9.5	13,500	
W15-217/ 114 ft	35	3	6/2/00 10:45	0.460	376.0	3.2	0.0	8.9	13,500	Duplicate
W15-217/ 114 ft	35	3	6/27/00 9:47	-0.290	358.0	2.1	0.0	9.5	11,700	
W15-217/ 114 ft	35	3	7/24/00 10:09	-0.180	185.0	1.1	1.0	8.5	10,600	
W15-217/ 114 ft	35	3	8/29/00 9:30	0.390	432.0	2.6	0.0	10.3	9,910	
W15-217/ 114 ft	35	3	9/25/00 9:50	-0.240	249.0	1.1	0.0	8.8	9,870	
W15-9L/ 176 ft	54	6	10/26/99 9:37	-0.160	8.6	0.0	0.0	1.9	9,810	
W15-9L/ 176 ft	54	6	11/30/99 12:56	0.290	12.0	0.0	0.0	2.3	12,700	
W15-9L/ 176 ft	54	6	12/29/99 10:21	0.900	12.1	0.0	0.0	1.9	8,340	
W15-9L/ 176 ft	54	6	1/25/00 10:40	--	14.4	0.0	0.0	2.6	10,400	Differential pressure transducer not functional.
W15-9L/ 176 ft	54	6	3/7/00 10:23	--	9.0	0.0	0.0	1.4	10,700	Differential pressure transducer not functional.
W15-9L/ 176 ft	54	6	6/2/00 10:58	0.310	12.3	0.0	0.0	2.7	11,800	
W15-9L/ 176 ft	54	6	6/27/00 10:00	-0.040	11.9	0.0	0.0	3.2	11,700	
W15-9L/ 176 ft	54	6	7/24/00 10:18	-0.280	11.0	0.0	0.0	2.2	10,800	
W15-9L/ 176 ft	54	6	8/29/00 9:57	0.530	20.4	0.0	0.0	3.6	11,400	
W15-9L/ 176 ft	54	6	9/25/00 10:03	-0.070	10.1	0.0	0.0	1.6	9,100	

Note: Concentrations recorded in this table as 0.0 ppmv were measured as <1.0 ppmv.

-- = no data

bgs = below ground surface

CCl4 = carbon tetrachloride

CH2Cl2 = methylene chloride

CHCl3 = chloroform

MEK = methylethyl ketone

ppmv = parts per million by volume

Table F-3. Carbon Tetrachloride Concentration Standard Analyses, October 1999 Through September 2000.

Carbon Tetrachloride Concentration Standard (ppmv)	Carbon Tetrachloride Concentration Analyzed (ppmv)	Date Analyzed	Time Analyzed	B&K Serial Number
25.5	26.3	10/26/99	10:38	1747619
25.5	26.9	10/26/99	11:30	1747619
25.5	25.6	11/30/99	14:00	1747619
25.5	26.3	11/30/99	15:10	1747619
25.5	26.0	12/29/99	11:30	1747619
25.5	26.7	12/29/99	12:18	1747619
25.5	25.8	01/25/00	11:22	1747619
25.5	26.5	01/25/00	12:10	1747619
25.5	25.9	03/07/00	11:02	1715232
25.5	26.2	03/07/00	11:52	1715232
200	177	03/07/00	0:00	1715232
25.5	25.7	06/02/00	9:08	1715232
200	167	06/02/00	9:46	1715232
25.5	25.9	06/02/00	12:03	1715232
25.5	26.6	06/02/00	12:45	1715232
200	178	06/02/00	12:53	1715232
25.5	26.2	06/27/00	12:40	1715232
25.5	26.2	06/27/00	13:28	1715232
200	165	06/27/00	13:54	1715232
25.5	26.3	07/24/00	12:24	1715232
25.5	26.5	07/24/00	13:10	1715232
200	178	07/24/00	13:22	1715232
25.5	26.0	08/29/00	11:29	1715232
25.5	26.3	08/29/00	12:17	1715232
200	209	08/29/00	12:22	1715232
25.5	25.8	09/25/00	11:17	1715232
25.5	26.2	09/25/00	12:05	1715232
200	200	09/25/00	12:11	1715232

Table F-4. Blank Analyses^a, October 1999 Through September 2000.

Sample Location	Sample Date	Sample Time	CCl ₄ (ppmv)	CHCl ₃ (ppmv)	MEK (ppmv)	CH ₂ Cl ₂ (ppmv)	Water (ppmv)
Blank	10/26/99	10:36	0.0	0.0	0.0	0.0	7,710
Blank	10/26/99	11:32	0.0	0.0	0.0	1.3	7,600
Blank	11/30/99	13:57	0.0	0.0	0.0	0.0	9,300
Blank	11/30/99	15:08	0.0	0.0	0.0	0.0	8,690
Blank	12/29/99	11:28	0.0	0.0	0.0	0.0	5,810
Blank	12/29/99	12:20	0.0	0.0	0.0	1.1	5,460
Blank	01/25/00	11:20	0.0	0.0	0.0	0.0	7,260
Blank	01/25/00	12:12	0.0	0.0	0.0	1.0	7,880
Blank	03/07/00	11:00	0.0	0.0	0.0	0.0	5,590
Blank	03/07/00	11:54	0.0	0.0	0.0	0.0	6,520
Blank	06/02/00	9:06	0.0	0.0	0.0	0.0	8,000
Blank	06/02/00	9:24	0.0	0.0	0.0	0.0	9,290
Blank	06/02/00	12:01	0.0	0.0	0.0	0.0	8,330
Blank	06/02/00	12:47	0.0	0.0	0.0	0.0	10,000
Blank	06/27/00	0:00	0.0	0.0	0.0	1.3	9,630
Blank	06/27/00	0:00	0.0	0.0	0.0	1.1	9,990
Blank	07/24/00	12:22	0.0	0.0	0.0	0.0	9,620
Blank	07/24/00	13:12	0.0	0.0	0.0	0.0	9,070
Blank	08/29/00	11:27	0.0	0.0	0.0	0.0	8,620
Blank	08/29/00	12:19	0.0	0.0	0.0	0.0	9,070
Blank	09/25/00	11:15	0.0	0.0	0.0	0.0	6,600
Blank	09/25/00	12:07	0.0	0.0	0.0	0.0	8,040

Note: Concentrations recorded in this table as 0.0 ppmv were measured as <1.0 ppmv.

^a Analyses of the vapor headspace in blank samples of deionized water.

CCl₄ = carbon tetrachloride

CHCl₃ = chloroform

MEK = methylethyl ketone

CH₂Cl₂ = methylene chloride

APPENDIX G
FISCAL YEAR 2001 SOIL VAPOR MONITORING DATA

Table G-1. Carbon Tetrachloride Concentrations Monitored at the 216-Z-1A/Z-18/Z-12 Wellfield During Nonoperation of the SVE System, October 2000 through September 2001. (5 Pages)

Sample Location	Depth (m bgs)	Zone	Sample		Differential Pressure (kPa)	CCl ₄ (ppmv)	CHCl ₃ (ppmv)	MEK (ppmv)	CH ₂ Cl ₂ (ppmv)	Water (ppmv)	Comment
			Date	Time							
CPT-4A/25 ft	8	2	4/30/2001	8:10	-0.012	3.5	0.0	0.0	1.6	11,600	
CPT-4A/25 ft	8	2	5/30/2001	8:14	-0.012	2.0	0.0	0.0	0.0	9,230	
CPT-4A/25 ft	8	2	6/29/2001	8:40	-0.005	0.0	0.0	0.0	1.2	10,400	
CPT-4A/25 ft	8	2	7/31/2001	8:53	-0.005	0.0	0.0	0.0	0.0	11,000	
CPT-4A/25 ft	8	2	8/30/2001	6:55	-0.007	0.0	0.0	0.0	1.4	12,600	
CPT-4A/25 ft	8	2	9/25/2001	9:42	0.037	0.0	0.0	0.0	1.5	10,000	
CPT-32/25 ft	8	2	10/31/2000	9:25	0.000	6.3	0.0	0.0	1.1	9,750	
CPT-32/25 ft	8	2	11/28/2000	8:57	-0.005	7.6	0.0	0.0	0.0	5,620	
CPT-32/25 ft	8	2	12/29/2000	7:30	0.002	11.9	0.0	0.0	0.0	7,020	
CPT-32/25 ft	8	2	2/12/2001	9:49	-0.030	16.5	0.0	0.0	1.2	3.95	Water analysis in units of T _{dew} (°C).
CPT-32/25 ft	8	2	2/28/2001	9:09	-0.002	5.7	0.0	0.0	0.0	6,930	
CPT-32/25 ft	8	2	3/20/2001	10:40	0.005	15.4	0.0	0.0	1.4	15,500	
CPT-32/25 ft	8	2	7/31/2001	9:43	0.000	0.0	0.0	0.0	0.0	13,400	
CPT-32/25 ft	8	2	8/30/2001	7:30	-0.007	0.0	0.0	0.0	1.4	14,400	
CPT-32/25 ft	8	2	9/25/2001	9:54	0.022	0.0	0.0	0.0	1.2	11,300	
CPT-30/28 ft	9	2	10/31/2000	9:20	-0.005	0.0	0.0	0.0	0.0	8,720	
CPT-30/28 ft	9	2	11/28/2000	8:50	0.000	0.0	0.0	0.0	0.0	5,790	
CPT-30/28 ft	9	2	12/29/2000	7:26	0.007	0.0	0.0	0.0	0.0	7,020	
CPT-30/28 ft	9	2	2/12/2001	9:42	-0.025	0.0	0.0	0.0	0.0	3.64	Water analysis in units of T _{dew} (°C).
CPT-30/28 ft	9	2	2/28/2001	9:04	-0.005	0.0	0.0	0.0	0.0	8,800	
CPT-30/28 ft	9	2	3/20/2001	10:34	0.005	0.0	1.2	0.0	0.0	14,500	
CPT-30/28 ft	9	2	7/31/2001	8:49	-0.002	0.0	0.0	0.0	1.1	10,700	
CPT-30/28 ft	9	2	8/30/2001	6:50	-0.005	0.0	0.0	0.0	1.0	12,200	
CPT-30/28 ft	9	2	9/25/2001	9:33	0.030	0.0	0.0	0.0	0.0	9,430	
CPT-13A/30 ft	9	2	10/31/2000	10:10	0.000	2.4	0.0	0.0	0.0	9,890	
CPT-13A/30 ft	9	2	11/28/2000	9:20	-0.012	2.3	0.0	0.0	0.0	5,840	
CPT-13A/30 ft	9	2	12/29/2000	7:43	-0.022	2.9	0.0	0.0	0.0	7,370	

Table G-1. Carbon Tetrachloride Concentrations Monitored at the 216-Z-1A/Z-18/Z-12 Wellfield During Nonoperation of the SVE System, October 2000 through September 2001. (5 Pages)

Sample Location	Depth (m bgs)	Zone	Sample		Differential Pressure (kPa)	CCl ₄ (ppmv)	CHCl ₃ (ppmv)	MEK (ppmv)	CH ₂ Cl ₂ (ppmv)	Water (ppmv)	Comment
			Date	Time							
CPT-13A/30 ft	9	2	2/12/2001	10:06	-0.037	2.2	0.0	0.0	0.0	5.94	Water analysis in units of T _{dew} (°C).
CPT-13A/30 ft	9	2	2/28/2001	9:37	-0.002	3.6	0.0	0.0	0.0	11,500	
CPT-13A/30 ft	9	2	3/20/2001	8:52	0.000	2.4	0.0	0.0	0.0	8,360	
CPT-13A/30 ft	9	2	4/30/2001	8:17	-0.002	2.5	0.0	0.0	0.0	11,400	
CPT-13A/30 ft	9	2	5/30/2001	8:20	-0.015	1.6	0.0	0.0	0.0	8,050	
CPT-13A/30 ft	9	2	6/29/2001	8:47	-0.002	0.0	0.0	0.0	0.0	10,400	
CPT-13A/30 ft	9	2	7/31/2001	10:03	0.010	0.0	0.0	0.0	0.0	14,200	
CPT-13A/30 ft	9	2	8/30/2001	7:39	-0.007	0.0	0.0	0.0	0.0	14,800	
CPT-13A/30 ft	9	2	9/25/2001	10:29	0.012	1.9	0.0	0.0	0.0	10,400	
CPT-7A/32 ft	10	2	10/31/2000	10:27	-0.002	4.3	0.0	0.0	0.0	11,300	
CPT-7A/32 ft	10	2	11/28/2000	9:37	-0.007	3.8	0.0	0.0	0.0	6,290	
CPT-7A/32 ft	10	2	12/29/2000	7:52	-0.090	5.2	0.0	0.0	0.0	7,680	
CPT-7A/32 ft	10	2	2/12/2001	10:17	-0.040	5.5	0.0	0.0	0.0	6.17	Water analysis in units of T _{dew} (°C).
CPT-7A/32 ft	10	2	2/28/2001	9:46	0.002	5.2	0.0	0.0	0.0	10,500	
CPT-7A/32 ft	10	2	3/20/2001	9:07	-0.005	5.1	0.0	0.0	0.0	8,520	
CPT-7A/32 ft	10	2	4/30/2001	8:24	-0.017	2.7	0.0	0.0	0.0	11,600	
CPT-7A/32 ft	10	2	5/30/2001	8:24	-0.017	1.9	0.0	0.0	0.0	9,280	
CPT-7A/32 ft	10	2	6/29/2001	8:52	-0.010	1.7	0.0	0.0	0.0	11,000	
CPT-7A/32 ft	10	2	7/31/2001	10:28	0.002	3.8	0.0	0.0	0.0	16,900	
CPT-7A/32 ft	10	2	8/30/2001	8:09	-0.010	4.2	0.0	0.0	1.1	18,100	
CPT-7A/32 ft	10	2	9/25/2001	10:38	0.022	4.1	0.0	0.0	0.0	10,700	
CPT-1A/35 ft	11	2	10/31/2000	9:07	-0.030	3.7	0.0	0.0	1.6	9,190	
CPT-1A/35 ft	11	2	11/28/2000	8:46	-0.002	5.1	0.0	0.0	1.0	5,810	
CPT-1A/35 ft	11	2	12/29/2000	7:22	0.007	4.9	0.0	0.0	1.3	6,970	
CPT-1A/35 ft	11	2	2/12/2001	9:33	-0.032	3.0	0.0	0.0	0.0	3.51	Water analysis in units of T _{dew} (°C).
CPT-1A/35 ft	11	2	2/28/2001	8:57	0.007	4.6	0.0	0.0	1.1	8,880	
CPT-1A/35 ft	11	2	3/20/2001	8:00	-0.010	4.2	0.0	0.0	0.0	6,630	

Table G-1. Carbon Tetrachloride Concentrations Monitored at the 216-Z-1A/Z-18/Z-12 Wellfield During Nonoperation of the SVE System, October 2000 through September 2001. (5 Pages)

Sample Location	Depth (m bgs)	Zone	Sample		Differential Pressure (kPa)	CCl ₄ (ppmv)	CHCl ₃ (ppmv)	MEK (ppmv)	CH ₂ Cl ₂ (ppmv)	Water (ppmv)	Comment
			Date	Time							
CPT-1A/35 ft	11	2	4/30/2001	8:00	0.012	4.8	0.0	0.0	1.7	11,000	
CPT-1A/35 ft	11	2	5/30/2001	8:00	-0.017	3.0	0.0	0.0	0.0	7,550	
CPT-1A/35 ft	11	2	6/29/2001	8:28	-0.015	7.7	1.0	0.0	1.6	10,400	
CPT-1A/35 ft	11	2	6/29/2001	8:28	-0.015	7.6	1.0	1.0	1.6	10,400	Duplicate
CPT-1A/35 ft	11	2	7/31/2001	8:20	-0.020	11.3	0.0	0.0	1.2	9,820	
CPT-1A/35 ft	11	2	8/30/2001	6:30	-0.007	10.5	0.0	0.0	1.4	12,000	
CPT-1A/35 ft	11	2	9/25/2001	9:17	0.022	9.5	1.1	0.0	1.8	9,350	
CPT-1A/35 ft	11	2	9/25/2001	9:58	0.134	9.4	1.0	1.0	1.8	9,430	Duplicate
CPT-33/40 ft	12	2	7/31/2001	8:41	-0.012	0.0	0.0	0.0	1.6	10,500	
CPT-33/40 ft	12	2	8/30/2001	6:45	-0.012	1.1	0.0	0.0	1.8	12,200	
CPT-33/40 ft	12	2	9/25/2001	9:28	0.035	1.6	0.0	0.0	1.9	9,580	
CPT-34/40 ft	12	2	4/30/2001	8:05	0.005	1.9	0.0	0.0	0.0	11,100	
CPT-34/40 ft	12	2	5/30/2001	8:07	-0.020	1.3	0.0	0.0	0.0	8,060	
CPT-34/40 ft	12	2	6/29/2001	8:34	-0.015	1.4	0.0	0.0	0.0	10,600	
CPT-34/40 ft	12	2	7/31/2001	8:32	-0.017	1.5	0.0	0.0	0.0	10,200	
CPT-34/40 ft	12	2	8/30/2001	6:40	-0.012	1.8	0.0	0.0	0.0	12,300	
CPT-34/40 ft	12	2	9/25/2001	9:24	0.037	2.2	0.0	0.0	0.0	9,910	
CPT-32/70 ft	21	2	7/31/2001	9:46	-0.060	4.0	1.4	1.2	1.6	12,700	
CPT-32/70 ft	21	2	8/30/2001	7:32	-0.030	3.9	1.2	1.1	1.7	14,400	
CPT-32/70 ft	21	2	9/25/2001	9:58	0.134	4.3	0.0	0.0	1.5	9,960	
CPT-4A/75 ft	23	2	9/25/2001	9:50	0.025	7.1	0.0	0.0	2.4	10,900	Substitute for CPT-4A/91 ft
CPT-1A/91 ft	28	2	7/31/2001	8:23	-0.007	5.7	0.0	0.0	1.7	10,400	
CPT-1A/91 ft	28	2	8/30/2001	6:34	-0.002	6.8	0.0	0.0	1.8	12,800	
CPT-1A/91 ft	28	2	9/25/2001	9:20	0.010	8.3	0.0	0.0	1.8	9,940	
CPT-4A/91 ft	28	2	7/31/2001	8:58	-0.134	7.5	0.0	0.0	2.3	10,200	Water noted in line at CPT-4A/91 ft
CPT-4A/91 ft	28	2	8/30/2001	7:00	-0.045	7.5	0.0	0.0	2.2	12,100	Water noted in line at CPT-4A/91 ft
W18-152/101 ft	31	2	10/31/2000	9:00	-0.080	2.9	0.0	0.0	0.0	9,300	

Table G-1. Carbon Tetrachloride Concentrations Monitored at the 216-Z-1A/Z-18/Z-12 Wellfield During Nonoperation of the SVE System, October 2000 through September 2001. (5 Pages)

Sample Location	Depth (m bgs)	Zone	Sample		Differential Pressure (kPa)	CCl ₄ (ppmv)	CHCl ₃ (ppmv)	MEK (ppmv)	CH ₂ Cl ₂ (ppmv)	Water (ppmv)	Comment
			Date	Time							
W18-152/101 ft	31	2	11/28/2000	8:26	-0.092	5.2	0.0	0.0	0.0	6,040	
W18-152/101 ft	31	2	12/29/2000	7:19	0.127	5.2	0.0	0.0	1.5	7,220	
W18-152/101 ft	31	2	2/12/2001	9:27	-0.105	3.8	1.1	0.0	0.0	1.35	Water analysis in units of T _{dew} (°C).
W18-152/101 ft	31	2	2/28/2001	8:52	0.065	8.0	0.0	0.0	0.0	8,320	
W18-152/101 ft	31	2	3/20/2001	7:55	-0.052	2.3	0.0	0.0	0.0	7,120	
W18-152/101 ft	31	2	7/31/2001	8:15	-0.147	10.2	0.0	1.5	2.3	10,500	
W18-152/101 ft	31	2	8/30/2001	6:25	-0.032	22.8	0.0	1.2	2.4	11,300	
W18-152/101 ft	31	2	9/25/2001	9:14	0.117	25.7	0.0	1.0	2.3	9,440	
W18-167/106 ft	32	3	10/31/2000	9:43	-0.070	171.0	0.0	0.0	5.3	10,700	
W18-167/106 ft	32	3	11/28/2000	8:40	-0.097	136.0	0.0	0.0	6.4	5,880	
W18-167/106 ft	32	3	12/29/2000	9:15	0.110	166.0	0.0	0.0	6.3	9,110	
W18-167/106 ft	32	3	2/12/2001	12:45	-0.025	166.0	0.0	0.0	3.6	15.7	Water analysis in units of T _{dew} (°C).
W18-167/106 ft	32	3	2/28/2001	9:23	0.032	135.0	0.0	0.0	2.6	12,000	
W18-167/106 ft	32	3	3/20/2001	10:55	-0.017	97.2	0.0	0.0	4.1	14,500	
W18-167/106 ft	32	3	7/31/2001	10:24	-0.087	283.0	0.0	0.0	3.7	14,100	
W18-167/106 ft	32	3	8/30/2001	8:03	-0.062	229.0	0.0	1.0	4.7	15,500	
W18-167/106 ft	32	3	9/25/2001	9:06	0.107	248.0	0.0	0.0	3.5	9,130	
W18-158L/120 ft	37	3	10/31/2000	9:37	-0.085	176.0	0.0	6.5	158.0	9,350	
W18-158L/120 ft	37	3	11/28/2000	8:34	-0.095	164.0	0.0	5.4	141.0	6,000	
W18-158L/120 ft	37	3	12/29/2000	9:08	0.120	197.0	0.0	5.9	145.0	9,170	
W18-158L/120 ft	37	3	2/12/2001	12:43	-0.015	239.0	0.0	6.2	122.0	16.6	Water analysis in units of T _{dew} (°C).
W18-158L/120 ft	37	3	2/28/2001	9:18	0.075	200.0	0.0	5.0	98.5	11,400	
W18-158L/120 ft	37	3	3/20/2001	10:50	-0.050	284.0	0.0	5.8	122.0	14,100	
W18-158L/120 ft	37	3	7/31/2001	10:14	-0.067	90.6	0.0	6.3	111.0	13,400	
W18-158L/120 ft	37	3	8/30/2001	7:58	-0.057	163.0	0.0	6.2	110.0	15,000	
W18-158L/120 ft	37	3	8/30/2001	7:58	-0.057	164.0	1.0	6.5	113.0	15,100	Duplicate
W18-158L/120 ft	37	3	9/25/2001	9:04	0.117	159.0	0.0	6.1	110.0	9,020	

Table G-1. Carbon Tetrachloride Concentrations Monitored at the 216-Z-1A/Z-18/Z-12 Wellfield During Nonoperation of the SVE System, October 2000 through September 2001. (5 Pages)

Sample Location	Depth (m bgs)	Zone	Sample		Differential Pressure (kPa)	CCl ₄ (ppmv)	CHCl ₃ (ppmv)	MEK (ppmv)	CH ₂ Cl ₂ (ppmv)	Water (ppmv)	Comment
			Date	Time							
W18-249/130 ft	40	3	10/31/2000	9:55	-0.070	51.0	0.0	0.0	4.0	10,500	
W18-249/130 ft	40	3	11/28/2000	9:11	-0.117	49.2	0.0	0.0	1.3	6,140	
W18-249/130 ft	40	3	11/28/2000	9:11	-0.117	48.8	1.0	1.0	1.2	6,200	Duplicate
W18-249/130 ft	40	3	12/29/2000	7:35	0.120	123.0	0.0	0.0	2.2	7,670	
W18-249/130 ft	40	3	2/12/2001	9:59	-0.254	52.1	0.0	0.0	0.0	5.46	Water analysis in units of T _{dew} (°C).
W18-249/130 ft	40	3	2/28/2001	9:31	0.085	125.0	0.0	0.0	0.0	12,000	
W18-249/130 ft	40	3	3/20/2001	8:40	-0.085	46.7	0.0	0.0	0.0	7,890	
W18-249/130 ft	40	3	7/31/2001	9:55	-0.125	44.6	0.0	1.1	1.5	12,400	
W18-249/130 ft	40	3	8/30/2001	7:45	-0.055	161.0	0.0	0.0	1.4	13,900	
W18-249/130 ft	40	3	9/25/2001	10:19	0.219	196.0	0.0	0.0	0.0	9,810	
W18-248/131 ft	40	3	10/31/2000	10:17	-0.122	177.0	0.0	0.0	3.6	10,300	
W18-248/131 ft	40	3	11/28/2000	9:27	-0.169	169.0	0.0	0.0	2.6	6,260	
W18-248/131 ft	40	3	12/29/2000	7:47	0.154	175.0	0.0	0.0	3.5	7,860	
W18-248/131 ft	40	3	2/12/2001	10:12	-0.468	214.0	0.0	0.0	0.0	5.99	Water analysis in units of T _{dew} (°C).
W18-248/131 ft	40	3	2/28/2001	9:40	0.012	164.0	0.0	0.0	0.0	11,300	
W18-248/131 ft	40	3	3/20/2001	8:57	-0.132	178.0	0.0	0.0	0.0	8,010	
W18-248/131 ft	40	3	7/31/2001	10:08	-0.172	306.0	0.0	0.0	0.0	13,000	
W18-248/131 ft	40	3	8/30/2001	7:52	-0.060	274.0	0.0	0.0	0.0	14,300	
W18-248/131 ft	40	3	9/25/2001	10:33	0.326	236.0	0.0	0.0	0.0	10,400	

Note: Concentrations recorded in this table as 0.0 ppmv were measured as <1.0 ppmv.

-- = no data

bgs = below ground surface

CCl₄ = carbon tetrachloride

CH₂Cl₂ = methylene chloride

CHCl₃ = chloroform

MEK = methylethyl ketone

ppmv = parts per million by volume

Table G-2. Carbon Tetrachloride Concentrations Monitored at the 216-Z-9 Wellfield During Nonoperation of the SVE System, October 2000 through September 2001. (7 Pages)

Sample Location	Depth (m bgs)	Zone	Sample		Differential Pressure (kPa)	CCl ₄ (ppmv)	CHCl ₃ (ppmv)	MEK (ppmv)	CH ₂ Cl ₂ (ppmv)	Water (ppmv)	Comment
			Date	Time							
CPT-17/10 ft	3	2	10/31/2000	10:44	0.005	4.3	0.0	0.0	0.0	10,700	
CPT-17/10 ft	3	2	11/28/2000	10:22	0.005	3.7	0.0	0.0	0.0	7,040	
CPT-17/10 ft	3	2	12/29/2000	8:08	-0.017	5.2	0.0	0.0	1.4	7,750	
CPT-17/10 ft	3	2	2/12/2001	10:30	-0.017	4.8	0.0	0.0	1.4	6.32	Water analysis in units of T _{dew} (°C).
CPT-17/10 ft	3	2	2/28/2001	9:55	0.000	5.7	0.0	0.0	1.5	8,670	
CPT-17/10 ft	3	2	3/20/2001	9:35	0.002	5.3	0.0	0.0	1.5	7,820	
CPT-17/10 ft	3	2	4/30/2001	8:45	0.007	6.6	0.0	0.0	2.3	11,400	
CPT-17/10 ft	3	2	5/30/2001	8:40	-0.002	5.1	0.0	0.0	1.9	9,110	
CPT-17/10 ft	3	2	6/29/2001	9:18	0.005	4.7	0.0	0.0	1.6	11,100	
CPT-18/15 ft	5	2	10/31/2000	10:54	0.002	1.7	0.0	0.0	1.6	11,100	
CPT-18/15 ft	5	2	11/28/2000	10:39	0.002	2.1	0.0	0.0	0.0	6,810	
CPT-18/15 ft	5	2	12/29/2000	8:18	-0.095	3.0	0.0	0.0	0.0	7,770	
CPT-18/15 ft	5	2	2/12/2001	10:49	-0.015	2.3	0.0	0.0	0.0	7.09	Water analysis in units of T _{dew} (°C).
CPT-18/15 ft	5	2	2/28/2001	10:24	0.005	1.5	0.0	0.0	0.0	10,500	
CPT-18/15 ft	5	2	3/20/2001	9:47	0.000	1.5	0.0	0.0	0.0	9,620	
CPT-18/15 ft	5	2	4/30/2001	8:59	0.007	3.2	0.0	0.0	1.3	11,400	
CPT-18/15 ft	5	2	5/30/2001	8:51	0.000	2.0	0.0	0.0	1.1	9,270	
CPT-18/15 ft	5	2	6/29/2001	9:27	0.005	2.5	0.0	0.0	0.0	10,700	
CPT-16/25 ft	8	2	10/31/2000	11:22	0.005	1.0	0.0	0.0	0.0	11,400	
CPT-16/25 ft	8	2	11/28/2000	11:20	0.005	0.0	0.0	0.0	0.0	6,700	
CPT-16/25 ft	8	2	12/29/2000	8:55	0.000	1.5	0.0	0.0	0.0	8,890	

Table G-2. Carbon Tetrachloride Concentrations Monitored at the 216-Z-9 Wellfield During Nonoperation of the SVE System, October 2000 through September 2001. (7 Pages)

Sample Location	Depth (m bgs)	Zone	Sample		Differential Pressure (kPa)	CCl ₄ (ppmv)	CHCl ₃ (ppmv)	MEK (ppmv)	CH ₂ Cl ₂ (ppmv)	Water (ppmv)	Comment
			Date	Time							
CPT-16/25 ft	8	2	2/12/2001	11:17	-0.012	1.1	0.0	0.0	0.0	11.6	Water analysis in units of T _{dew} (°C).
CPT-16/25 ft	8	2	2/28/2001	10:38	0.000	1.5	0.0	0.0	0.0	10,300	
CPT-16/25 ft	8	2	3/20/2001	10:23	0.002	1.3	0.0	0.0	0.0	12,900	
CPT-16/25 ft	8	2	4/30/2001	10:28	0.012	1.3	0.0	0.0	0.0	13,400	
CPT-16/25 ft	8	2	5/30/2001	7:35	0.000	0.0	0.0	0.0	0.0	8,030	
CPT-16/25 ft	8	2	6/29/2001	10:46	0.012	1.3	0.0	0.0	0.0	12,600	
CPT-27/33 ft	10	2	10/31/2000	11:14	0.007	0.0	0.0	0.0	0.0	10,700	
CPT-27/33 ft	10	2	11/28/2000	11:12	-0.002	1.2	0.0	0.0	0.0	6,720	
CPT-27/33 ft	10	2	12/29/2000	8:48	0.002	2.6	0.0	0.0	1.6	8,800	
CPT-27/33 ft	10	2	2/12/2001	11:14	-0.017	2.3	0.0	0.0	1.5	10.4	Water analysis in units of T _{dew} (°C).
CPT-27/33 ft	10	2	2/28/2001	10:33	-0.002	2.6	0.0	0.0	1.3	11,800	
CPT-27/33 ft	10	2	3/20/2001	10:19	-0.002	2.0	0.0	0.0	1.2	12,700	
CPT-27/33 ft	10	2	4/30/2001	10:03	0.005	2.6	0.0	0.0	1.3	13,500	
CPT-27/33 ft	10	2	5/30/2001	7:31	-0.005	1.4	0.0	0.0	0.0	8,190	
CPT-27/33 ft	10	2	6/29/2001	10:30	0.015	1.7	0.0	0.0	0.0	12,300	
CPT-28/40 ft	12	2	7/31/2001	10:40	0.000	52.8	0.0	1.1	2.1	17,800	
CPT-28/40 ft	12	2	8/30/2001	8:24	-0.027	54.8	1.2	0.0	1.9	19,500	
CPT-28/40 ft	12	2	9/25/2001	10:46	0.062	56.5	0.0	0.0	1.7	10,700	
CPT-21A/45 ft	14	2	10/31/2000	10:36	0.000	80.8	0.0	0.0	3.5	11,600	
CPT-21A/45 ft	14	2	11/28/2000	10:08	-0.027	84.4	0.0	0.0	3.7	7,190	
CPT-21A/45 ft	14	2	12/29/2000	8:00	0.047	92.8	0.0	0.0	4.1	7,790	

Table G-2. Carbon Tetrachloride Concentrations Monitored at the 216-Z-9 Wellfield During Nonoperation of the SVE System, October 2000 through September 2001. (7 Pages)

Sample Location	Depth (m bgs)	Zone	Sample		Differential Pressure (kPa)	CCl ₄ (ppmv)	CHCl ₃ (ppmv)	MEK (ppmv)	CH ₂ Cl ₂ (ppmv)	Water (ppmv)	Comment
			Date	Time							
CPT-21A/45 ft	14	2	2/12/2001	10:35	-0.149	81.6	0.0	0.0	2.1	6.32	Water analysis in units of T _{dew} (°C).
CPT-21A/45 ft	14	2	2/28/2001	9:59	0.022	86.8	0.0	0.0	2.4	9,260	
CPT-21A/45 ft	14	2	3/20/2001	9:22	0.000	65.8	0.0	0.0	2.1	8,510	
CPT-21A/45 ft	14	2	4/30/2001	8:38	0.042	127.0	0.0	0.0	3.3	11,800	
CPT-21A/45 ft	14	2	5/30/2001	8:32	-0.057	86.8	0.0	0.0	2.8	9,420	
CPT-21A/45 ft	14	2	6/29/2001	9:00	-0.017	91.8	0.0	0.0	3.1	11,100	
CPT-21A/45 ft	14	2	7/31/2001	10:48	-0.027	90.9	0.0	0.0	3.2	18,400	
CPT-21A/45 ft	14	2	8/30/2001	8:33	-0.045	133.0	0.0	0.0	3.5	21,000	
CPT-21A/45 ft	14	2	9/25/2001	11:00	0.090	126.0	0.0	0.0	2.5	12,000	
W15-220SST/52 ft	16	3	4/30/2001	10:08	0.052	2.5	0.0	0.0	0.0	13,300	
W15-220SST/52 ft	16	3	5/30/2001	7:39	-0.050	1.9	0.0	0.0	0.0	7,850	
W15-220SST/52 ft	16	3	5/30/2001	7:39	-0.050	1.9	1.0	1.0	1.0	7,840	Duplicate.
W15-220SST/52 ft	16	3	6/29/2001	10:35	0.035	2.4	0.0	0.0	0.0	11,600	
CPT-9A/60 ft	18	2	10/31/2000	11:26	0.015	38.1	0.0	0.0	3.5	11,900	
CPT-9A/60 ft	18	2	11/28/2000	11:29	0.050	38.2	0.0	0.0	2.7	7,230	
CPT-9A/60 ft	18	2	12/29/2000	9:00	0.035	42.9	0.0	0.0	3.5	8,830	
CPT-9A/60 ft	18	2	2/12/2001	11:25	-0.067	36.1	0.0	0.0	1.9	11.4	Water analysis in units of T _{dew} (°C).
CPT-9A/60 ft	18	2	2/28/2001	10:43	0.010	31.5	0.0	0.0	2.0	10,600	
CPT-9A/60 ft	18	2	3/20/2001	10:30	0.002	34.3	0.0	0.0	1.9	13,000	
CPT-9A/60 ft	18	2	3/20/2001	10:30	0.002	34.7	1.0	1.0	1.4	13,100	Duplicate.
CPT-9A/60 ft	18	2	4/30/2001	10:45	0.047	37.1	0.0	0.0	2.3	13,900	

Table G-2. Carbon Tetrachloride Concentrations Monitored at the 216-Z-9 Wellfield During Nonoperation of the SVE System, October 2000 through September 2001. (7 Pages)

Sample Location	Depth (m bgs)	Zone	Sample		Differential Pressure (kPa)	CCl ₄ (ppmv)	CHCl ₃ (ppmv)	MEK (ppmv)	CH ₂ Cl ₂ (ppmv)	Water (ppmv)	Comment
			Date	Time							
CPT-9A/60 ft	18	2	5/30/2001	7:53	-0.047	35.6	0.0	0.0	2.1	8,330	
CPT-9A/60 ft	18	2	6/29/2001	10:52	0.042	37.6	0.0	0.0	2.1	13,500	
CPT-9A/60 ft	18	2	7/31/2001	10:59	-0.002	38.1	0.0	0.0	2.6	22,500	
CPT-9A/60 ft	18	2	8/30/2001	8:43	-0.017	39.0	0.0	0.0	2.9	22,900	
CPT-9A/60 ft	18	2	9/25/2001	11:10	0.047	45.3	0.0	0.0	2.6	12,400	
W15-219/70 ft	21	2	4/30/2001	9:18	0.045	7.7	0.0	0.0	5.1	12,000	
W15-219/70 ft	21	2	5/30/2001	9:05	-0.035	7.0	0.0	0.0	5.0	9,940	
W15-219/70 ft	21	2	6/29/2001	9:38	-0.017	7.8	0.0	0.0	5.1	10,700	
CPT-18/75 ft	23	2	4/30/2001	9:02	0.060	16.0	0.0	0.0	6.9	12,100	
CPT-18/75 ft	23	2	5/30/2001	8:53	0.027	17.7	0.0	1.2	7.2	10,200	
CPT-18/75 ft	23	2	6/29/2001	9:33	0.000	15.0	0.0	0.0	4.7	11,100	
W15-82/83 ft	25	2	10/31/2000	11:09	0.000	1.2	0.0	1.3	21.3	11,900	Well cap off (downhole video camera survey conducted 10/31/00). Well resampled 11/1/00.
W15-82/83 ft	25	2	11/1/2000	11:50	0.042	6.1	0.0	0.0	14.4	15,600	
W15-82/83 ft	25	2	11/28/2000	11:05	-0.020	1.9	0.0	0.0	0.0	8,030	
W15-82/83 ft	25	2	12/29/2000	8:45	0.122	51.0	0.0	0.0	10.5	8,510	
W15-82/83 ft	25	2	2/12/2001	11:09	-0.194	19.9	0.0	0.0	4.1	10.3	Water analysis in units of T _{dew} (°C).
W15-82/83 ft	25	2	2/28/2001	10:29	0.107	47.1	0.0	0.0	5.3	10,400	
W15-82/83 ft	25	2	3/20/2001	10:10	-0.062	2.4	0.0	0.0	0.0	11,000	
W15-82/83 ft	25	2	4/30/2001	9:44	0.127	55.0	0.0	0.0	6.6	13,000	
W15-82/83 ft	25	2	5/30/2001	7:27	-0.179	1.5	0.0	0.0	0.0	7,480	

Table G-2. Carbon Tetrachloride Concentrations Monitored at the 216-Z-9 Wellfield During Nonoperation of the SVE System, October 2000 through September 2001. (7 Pages)

Sample Location	Depth (m bgs)	Zone	Sample		Differential Pressure (kPa)	CCl ₄ (ppmv)	CHCl ₃ (ppmv)	MEK (ppmv)	CH ₂ Cl ₂ (ppmv)	Water (ppmv)	Comment
			Date	Time							
W15-82/83 ft	25	2	6/29/2001	10:27	0.030	15.3	0.0	0.0	2.2	11,000	
CPT-21A/86 ft	26	2	10/31/2000	10:40	-0.005	164.0	0.0	0.0	4.6	11,500	
CPT-21A/86 ft	26	2	10/31/2000	12:48	-0.005	160.0	0.0	0.0	4.7	10,900	Duplicate.
CPT-21A/86 ft	26	2	11/28/2000	10:11	-0.050	148.0	0.0	0.0	4.2	6,800	
CPT-21A/86 ft	26	2	12/29/2000	8:03	0.110	161.0	0.0	0.0	5.0	7,830	
CPT-21A/86 ft	26	2	12/29/2000	8:03	0.110	148.0	1.0	1.0	4.8	7,870	Duplicate.
CPT-21A/86 ft	26	2	2/12/2001	10:39	-0.227	153.0	0.0	0.0	1.7	6.74	Water analysis in units of T _{dew} (°C).
CPT-21A/86 ft	26	2	2/28/2001	10:03	0.070	172.0	0.0	0.0	1.9	9,670	
CPT-21A/86 ft	26	2	3/20/2001	9:25	-0.045	121.0	0.0	0.0	1.7	8,590	
CPT-21A/86 ft	26	2	4/30/2001	8:42	0.095	188.0	0.0	0.0	2.5	11,700	
CPT-21A/86 ft	26	2	5/30/2001	8:35	-0.115	139.0	0.0	0.0	2.5	9,290	
CPT-21A/86 ft	26	2	6/29/2001	9:02	-0.040	161.0	0.0	0.0	2.5	11,200	
CPT-21A/86 ft	26	2	7/31/2001	10:51	-0.082	179.0	0.0	0.0	2.8	20,000	
CPT-21A/86 ft	26	2	8/30/2001	8:46	-0.082	186.0	0.0	0.0	2.9	21,400	
CPT-21A/86 ft	26	2	9/25/2001	11:03	0.164	184.0	0.0	0.0	2.5	12,100	
W15-95/86 ft	26	2	10/31/2000	11:04	-0.149	1.1	0.0	0.0	1.8	11,800	Well cap off (downhole video camera survey conducted 10/31/00). Well resampled 11/1/00.
W15-95/86 ft	26	2	11/1/2000	11:46	-0.625	30.2	0.0	0.0	8.0	14,500	
W15-95/86 ft	26	2	11/28/2000	10:57	-0.040	30.6	0.0	0.0	8.1	7,240	
W15-95/86 ft	26	2	12/29/2000	8:40	0.137	39.1	0.0	0.0	9.2	8,450	
W15-95/86 ft	26	2	2/12/2001	11:04	-0.209	32.1	0.0	0.0	5.9	9.59	Water analysis in units of T _{dew} (°C).

Table G-2. Carbon Tetrachloride Concentrations Monitored at the 216-Z-9 Wellfield During Nonoperation of the SVE System, October 2000 through September 2001. (7 Pages)

Sample Location	Depth (m bgs)	Zone	Sample		Differential Pressure (kPa)	CCl ₄ (ppmv)	CHCl ₃ (ppmv)	MEK (ppmv)	CH ₂ Cl ₂ (ppmv)	Water (ppmv)	Comment
			Date	Time							
W15-95/86 ft	26	2	2/12/2001	11:04	-0.209	32.5	0.0	1.0	6.0	9.11	Duplicate. Water analysis in units of T _{dew} (°C).
W15-95/86 ft	26	2	2/28/2001	10:16	0.102	35.5	0.0	0.0	5.4	10,700	
W15-95/86 ft	26	2	3/20/2001	10:00	-0.087	42.8	0.0	0.0	6.7	10,600	
CPT-28/87 ft	27	2	10/31/2000	10:30	-0.010	127.0	0.0	0.0	2.7	10,900	
CPT-28/87 ft	27	2	11/28/2000	9:56	-0.125	135.0	0.0	0.0	2.7	6,890	
CPT-28/87 ft	27	2	12/29/2000	7:56	0.127	197.0	0.0	0.0	4.4	7,740	
CPT-28/87 ft	27	2	2/12/2001	10:24	-0.242	146.0	0.0	0.0	1.4	6.72	Water analysis in units of T _{dew} (°C).
CPT-28/87 ft	27	2	2/28/2001	9:52	0.030	188.0	0.0	0.0	0.0	9,830	
CPT-28/87 ft	27	2	3/20/2001	9:14	-0.057	121.0	0.0	0.0	0.0	7,210	
CPT-28/87 ft	27	2	4/30/2001	8:29	0.075	224.0	0.0	0.0	0.0	11,900	
CPT-28/87 ft	27	2	5/30/2001	8:28	-0.112	148.0	0.0	0.0	1.3	9,320	
CPT-28/87 ft	27	2	6/29/2001	8:56	-0.045	174.0	0.0	0.0	1.1	11,400	
CPT-28/87 ft	27	2	7/31/2001	10:43	-0.077	167.0	0.0	0.0	1.7	18,700	
CPT-28/87 ft	27	2	8/30/2001	8:29	-0.080	225.0	0.0	0.0	1.7	20,700	
CPT-28/87 ft	27	2	9/25/2001	10:48	0.184	220.0	0.0	0.0	1.4	11,400	
CPT-9A/91 ft	28	2	7/31/2001	11:03	-0.045	57.2	0.0	1.2	4.0	24,400	
CPT-9A/91 ft	28	2	7/31/2001	11:03	-0.045	57.3	1.0	1.2	4.0	24,400	Duplicate.
CPT-9A/91 ft	28	2	8/30/2001	8:46	-0.060	62.3	0.0	0.0	3.9	22,900	
CPT-9A/91 ft	28	2	9/25/2001	11:12	0.137	74.3	0.0	0.0	3.8	12,200	
W15-85/91 ft	28	2	4/30/2001	9:39	0.120	51.3	0.0	0.0	3.7	12,600	

Table G-2. Carbon Tetrachloride Concentrations Monitored at the 216-Z-9 Wellfield During Nonoperation of the SVE System, October 2000 through September 2001. (7 Pages)

Sample Location	Depth (m bgs)	Zone	Sample		Differential Pressure (kPa)	CCl ₄ (ppmv)	CHCl ₃ (ppmv)	MEK (ppmv)	CH ₂ Cl ₂ (ppmv)	Water (ppmv)	Comment
			Date	Time							
W15-85/91 ft	28	2	4/30/2001	9:39	0.120	53.6	1.0	1.0	3.8	12,200	Duplicate.
W15-85/91 ft	28	2	5/30/2001	7:22	-0.247	18.8	0.0	0.0	1.9	7,690	
W15-85/91 ft	28	2	6/29/2001	10:16	0.017	16.9	0.0	0.0	2.4	11,100	
W15-217/114 ft	35	3	10/31/2000	10:48	-0.090	130.0	0.0	0.0	8.1	11,400	Well resampled 11/1/00.
W15-217/114 ft	35	3	11/1/2000	11:30	-0.027	105.0	0.0	0.0	6.0	12,500	
W15-217/114 ft	35	3	11/28/2000	10:31	-0.137	205.0	0.0	0.0	10.9	7,010	
W15-217/114 ft	35	3	12/29/2000	8:12	0.015	290.0	1.1	0.0	10.4	7,740	
W15-217/114 ft	35	3	2/12/2001	10:45	-0.184	160.0	0.0	0.0	2.7	5.96	Water analysis in units of T _{dew} (°C).
W15-217/114 ft	35	3	2/28/2001	10:08	0.132	339.0	0.0	0.0	2.1	10,200	
W15-217/114 ft	35	3	3/20/2001	9:40	-0.085	86.5	0.0	0.0	4.3	9,220	
W15-217/114 ft	35	3	4/30/2001	8:49	0.130	360.0	0.0	0.0	4.5	11,500	
W15-217/114 ft	35	3	5/30/2001	8:47	-0.177	124.0	0.0	0.0	5.6	9,450	
W15-217/114 ft	35	3	6/29/2001	9:22	-0.097	153.0	0.0	0.0	5.8	10,700	
CPT-24/118 ft	36	2	4/30/2001	9:34	0.174	35.2	0.0	0.0	2.9	12,500	
CPT-24/118 ft	36	2	5/30/2001	9:31	-0.154	14.2	0.0	0.0	1.5	11,600	
CPT-24/118 ft	36	2	6/29/2001	10:12	-0.005	17.1	0.0	0.0	1.7	14,500	
W15-220SST/118 ft	36	3	4/30/2001	10:11	0.152	34.0	0.0	0.0	0.0	13,200	
W15-220SST/118 ft	36	3	5/30/2001	7:42	-0.722	17.6	0.0	0.0	0.0	7,720	
W15-220SST/118 ft	36	3	6/29/2001	10:38	-0.259	26.7	0.0	0.0	1.1	11,700	
W15-219SST/130 ft	40	3	4/30/2001	9:25	0.110	54.4	0.0	0.0	3.7	12,000	
W15-219SST/130 ft	40	3	5/30/2001	9:17	-0.680	40.1	0.0	0.0	3.3	10,100	

Table G-2. Carbon Tetrachloride Concentrations Monitored at the 216-Z-9 Wellfield During Nonoperation of the SVE System, October 2000 through September 2001. (7 Pages)

Sample Location	Depth (m bgs)	Zone	Sample		Differential Pressure (kPa)	CCl ₄ (ppmv)	CHCl ₃ (ppmv)	MEK (ppmv)	CH ₂ Cl ₂ (ppmv)	Water (ppmv)	Comment
			Date	Time							
W15-219SST/130 ft	40	3	6/29/2001	9:50	-0.319	36.0	0.0	0.0	3.2	10,500	
W15-219SST/155 ft	47	3	4/30/2001	9:30	0.159	43.6	0.0	0.0	2.9	11,800	
W15-219SST/155 ft	47	3	5/30/2001	9:26	-0.712	4.1	0.0	0.0	0.0	10,100	
W15-219SST/155 ft	47	3	6/29/2001	10:02	-0.324	11.4	0.0	0.0	1.2	10,800	
W15-9L/176 ft	54	6	10/31/2000	10:58	-0.045	5.9	0.0	0.0	1.5	10,500	Well resampled 11/1/00.
W15-9L/176 ft	54	6	11/1/2000	11:35	-0.040	5.5	0.0	0.0	0.0	10,200	
W15-9L/176 ft	54	6	11/28/2000	10:51	-0.057	8.8	0.0	0.0	0.0	6,790	
W15-9L/176 ft	54	6	12/29/2000	8:35	0.025	8.3	0.0	0.0	1.6	8,410	
W15-9L/176 ft	54	6	2/12/2001	10:57	-0.242	5.8	0.0	0.0	1.2	8.60	Water analysis in units of T _{dew} (°C).
W15-9L/176 ft	54	6	2/28/2001	10:13	-0.002	5.2	0.0	0.0	0.0	10,600	
W15-9L/176 ft	54	6	2/28/2001	10:13	-0.002	3.2	0.0	0.0	0.0	10,600	Duplicate.
W15-9L/176 ft	54	6	3/20/2001	9:55	-0.012	1.4	0.0	0.0	0.0	10,100	
W15-220SST/185 ft	56	3	4/30/2001	10:14	0.137	14.5	0.0	0.0	1.5	13,000	
W15-220SST/185 ft	56	3	5/30/2001	7:47	-0.710	12.5	0.0	0.0	1.3	7,930	
W15-220SST/185 ft	56	3	6/29/2001	10:42	-0.254	14.2	0.0	0.0	1.4	11,800	

Note: Concentrations recorded in this table as 0.0 ppmv were measured as <1.0 ppmv.

-- = no data

bgs = below ground surface

CCl₄ = carbon tetrachloride

CH₂Cl₂ = methylene chloride

CHCl₃ = chloroform

MEK = methylethyl ketone

ppmv = parts per million by volume

**Appendix G – Fiscal Year 2001 Soil Vapor
Monitoring Data**

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**Table G-3. Carbon Tetrachloride Concentration Standard Analyses,
October 2000 through September 2001. (2 Pages)**

Carbon Tetrachloride Concentration Standard (ppmv)	Carbon Tetrachloride Concentration Analyzed (ppmv)	Date Analyzed	Time Analyzed	B&K Serial Number
25.5	26.1	10/31/00	11:41	1715232
25.5	26.2	10/31/00	12:05	1715232
200	203	10/31/00	13:09	1715232
25.5	25.5	11/01/00	12:00	1715232
25.5	26.4	11/01/00	12:18	1715232
200	198	11/01/00	12:27	1715232
25.5	25.5	11/28/00	12:02	1715232
25.5	25.8	11/28/00	12:50	1715232
200	168	11/28/00	12:56	1715232
25.5	25.6	12/29/00	9:37	1715232
25.5	25.9	12/29/00	10:29	1715232
200	233	12/29/00	10:35	1715232
25.5	25.2	02/12/01	11:47	1715232
25.5	26.2	02/12/01	12:58	1715232
200	167	02/12/01	13:18	1715232
25.5	25.2	02/28/01	11:08	1747619
25.5	25.2	02/28/01	12:04	1747619
200	170	02/28/01	12:20	1747619
25.5	24.7	03/20/01	11:34	1715232
25.5	25.1	03/20/01	12:22	1715232
200	149	03/20/01	12:30	1715232
25.5	24.8	04/30/01	10:59	1715232
25.5	25.7	04/30/01	11:51	1715232
200	157	04/30/01	12:00	1715232
25.5	25.6	05/30/01	10:26	1715232
25.5	25.5	05/30/01	11:18	1715232
200	212	05/30/01	11:34	1715232
25.5	24.9	06/29/01	11:52	1715232
25.5	25.1	06/29/01	12:44	1715232
200	207	06/29/01	12:50	1715232

**Appendix G – Fiscal Year 2001 Soil Vapor
Monitoring Data**

BHI-00720

Rev. 6

**Table G-3. Carbon Tetrachloride Concentration Standard Analyses,
October 2000 through September 2001. (2 Pages)**

Carbon Tetrachloride Concentration Standard (ppmv)	Carbon Tetrachloride Concentration Analyzed (ppmv)	Date Analyzed	Time Analyzed	B&K Serial Number
25.5	24.4	07/31/01	12:01	1715232
25.5	26.5	07/31/01	12:49	1715232
200	177	07/31/01	12:54	1715232
25.5	22.6	08/30/01	9:02	1715232
25.5	24.7	08/30/01	9:50	1715232
200	235	08/30/01	9:57	1715232
25.5	30.8	09/25/01	12:32	1715232
25.5	25.7	09/25/01	13:29	1715232
200	165	09/25/01	13:38	1715232

**Appendix G – Fiscal Year 2001 Soil Vapor
Monitoring Data**

BHI-00720

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Table G-4. Blank Analyses^a, October 2000 through September 2001.

Sample Location	Sample Date	Sample Time	CCl ₄ (ppmv)	CHCl ₃ (ppmv)	MEK (ppmv)	CH ₂ Cl ₂ (ppmv)	Water (ppmv)	Comments
Blank	10/31/2000	11:39	0.0	0.0	0.0	0.0	7,300	
Blank	10/31/2000	13:00	0.0	0.0	0.0	0.0	8,740	
Blank	11/1/2000	11:25	0.0	0.0	0.0	0.0	6,200	
Blank	11/1/2000	12:10	0.0	0.0	0.0	0.0	6,000	
Blank	11/28/2000	12:00	0.0	0.0	0.0	0.0	5,670	
Blank	11/28/2000	12:52	0.0	0.0	0.0	0.0	6,210	
Blank	12/29/2000	9:35	0.0	0.0	0.0	0.0	7,200	
Blank	12/29/2000	10:29	0.0	0.0	0.0	0.0	8,550	
Blank	2/12/2001	11:45	0.0	0.0	0.0	0.0	6.50	Water analysis in units of T _{dew} (°C).
Blank	2/12/2001	13:16	0.0	0.0	0.0	0.0	3.15	Water analysis in units of T _{dew} (°C).
Blank	02/28/01	11:06	0.0	0.0	0.0	0.0	5,330	
Blank	02/28/01	12:06	0.0	0.0	0.0	0.0	5,940	
Blank	03/20/01	11:32	0.0	0.0	0.0	0.0	5,980	
Blank	03/20/01	12:24	0.0	0.0	0.0	0.0	7,280	
Blank	04/30/01	10:57	0.0	0.0	0.0	0.0	9,000	
Blank	04/30/01	11:53	0.0	0.0	0.0	0.0	9,110	
Blank	05/30/01	10:24	0.0	0.0	0.0	0.0	7,330	
Blank	05/30/01	11:20	0.0	0.0	0.0	0.0	7,400	
Blank	06/29/01	11:50	0.0	0.0	0.0	0.0	8,260	
Blank	06/29/01	12:46	0.0	0.0	0.0	0.0	8,740	
Blank	07/31/01	11:59	0.0	0.0	0.0	0.0	8,090	
Blank	07/31/01	12:51	0.0	0.0	0.0	0.0	8,760	
Blank	08/30/01	9:00	0.0	0.0	0.0	0.0	9,150	
Blank	08/30/01	9:52	0.0	0.0	0.0	0.0	8,250	
Blank	09/25/01	12:30	0.0	0.0	0.0	0.0	8,460	
Blank	09/25/01	13:31	0.0	0.0	0.0	0.0	7,640	

Note: Concentrations recorded in this table as 0.0 ppmv were measured as <1.0 ppmv.

^a Analyses of the vapor headspace in blank samples of deionized water.

CCl₄ = carbon tetrachloride

CHCl₃ = chloroform

MEK = methylethyl ketone

CH₂Cl₂ = methylene chloride

APPENDIX H

**2001 CARBON TETRACHLORIDE
CONCEPTUAL MODEL UPDATE**

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APPENDIX H

2001 CARBON TETRACHLORIDE CONCEPTUAL MODEL UPDATE

Virginia Rohay and Craig Swanson

This appendix presents the current conceptual model as well as working hypotheses concerning the source term, environmental setting, vadose zone and groundwater contaminant distribution, vadose zone and groundwater transport, atmospheric losses, and biological degradation of carbon tetrachloride and associated contaminants in the 200 West Area. The conceptual model of the 200 West Area carbon tetrachloride plume has been continuously refined as additional site-specific data have been collected and as the understanding of dense nonaqueous-phase liquid (DNAPL) behavior in the subsurface has been developed by the scientific community. The conceptual model presented in this report provides an update to and includes information from the conceptual models presented in Rohay and Johnson (1991), Last and Rohay (1991, 1993), Last et al. (1991), Rohay et al. (1994a) and, most recently, Swanson et al. (1999).

Carbon tetrachloride contamination comprises two relatively distinct zones: a higher concentration zone in the source area and a lower concentration zone surrounding the source area. Possible transport mechanisms and distributions of contaminant phases for the high-concentration portion of the plume, which may also contain DNAPL/residual carbon tetrachloride, are depicted in Figure H-1. Because of the differences in the sizes of the three primary disposal sites and the quantities of waste received at these disposal sites, it may be that one transport mechanism and resulting contaminant distribution (e.g., vapor-phase and aqueous-phase migration to groundwater) is more appropriate for one or two disposal sites and that another transport mechanism and contaminant distribution (e.g., DNAPL, vapor-phase, and aqueous-phase migration to groundwater) is more appropriate for the other(s).

H1.1 SOURCE TERM

Between 1955 and 1973, a total of 363,000 to 580,000 L (577,000 to 922,000 kg) of liquid carbon tetrachloride, in mixtures with other organic and aqueous actinide-bearing liquids, was discharged to the soil column at three subsurface disposal facilities (216-Z-9 Trench, 216-Z-1A Tile Field, and 216-Z-18 Crib) near Z Plant (Plutonium Finishing Plant) in the 200 West Area (Figure 2-1). The organic solutions consisted of 50% to 85% by volume carbon tetrachloride mixed with either tributyl phosphate (TBP), dibutyl butyl phosphonate (DBBP), or lard oil (Table H-1). The solvent that was discharged to the soil column also contained dibutyl phosphate (DBP), a degradation product of TBP. These organic solutions made up only approximately 4% to 8% of the total volume of liquid waste discharged to the disposal facilities. The predominant wastes discharged were acidic, high-salt (sodium nitrate), aqueous wastes containing the above organic solutions in saturated amounts (<1%). The organic solutions were periodically discharged to the predominantly water-wetted soil column in small (100- to 200-L)

batches. Thus, carbon tetrachloride was introduced to the vadose zone as an aqueous phase and also as a DNAPL.

Three other sites in the vicinity of Z Plant also received some carbon tetrachloride wastes: the 216-Z-12 Crib, the 216-Z-19 Ditch, and the 216-T-19 Crib (Figure 2-1). The 216-Z-12 Crib received analytical and development laboratory waste from Z Plant from 1959 to 1973 and is estimated to have received a small volume of organics, which included carbon tetrachloride (Kasper 1982). The 216-Z-19 Ditch was used to convey process cooling water and steam condensate from Z Plant from 1971 to 1981; apparently, carbon tetrachloride was also occasionally and/or accidentally released to this ditch (e.g., as a result of steam and/or cooling water coil leaks) because heavy organic was noted in the outfall (DOE-RL 1991, Appendix A). Between 1973 and 1976, aqueous waste saturated with carbon tetrachloride was sent to the 242-T Evaporator; during that time, the 216-T-19 Crib received approximately 1,400 kg (880 L) of carbon tetrachloride in the overhead condensate discharged from this evaporator (Rohay et al. 1993).

H1.2 ENVIRONMENTAL SETTING

The vadose zone underlying the carbon tetrachloride disposal sites ranges in thickness from 64 m to 69 m and consists primarily of unconsolidated to partially consolidated gravel-, sand-, and silt-dominated deposits of the Pleistocene Hanford and late Miocene to Pliocene Ringold formations (Table H-2). Between these two units, the relatively less permeable Plio-Pleistocene unit, typically containing an increase in calcium carbonate content ("caliche layer"), occurs at approximately 38 to 45 m below the ground surface and ranges in thickness from 2 to 11 m (Table H-3). Cross sections summarizing the stratigraphy near the disposal sites are presented in Figures 2-2a, 2-2b, and 2-2c.

The physical characteristics of the vadose zone in this area are summarized as follows. The field moisture content is typically higher in the Plio-Pleistocene unit (Table H-2). The permeability of the vadose zone is horizontally and vertically variable in the carbon tetrachloride disposal area: horizontal intrinsic permeabilities range from approximately 10^{-13} to 10^{-10} m²; and corresponding air conductivities range from 0.05 to 25 m/day (equivalent hydraulic conductivities range from 0.5 to 231 m/day) (Rohay and McMahon 1996) (Table H-2). The natural organic carbon content (f_{oc}) of the vadose zone sediments is low (0.11% in silty sand collected from 40- to 43-m depth in well 299-W15-31) (Ford 1996). The soil grain surface area is higher for the silty sand (26.8 m²/g) than for a commercially available silica sand (0.32 m²/g) (Ford 1996). Perched groundwater has been encountered at the Plio-Pleistocene zone, and airflow through the Plio-Pleistocene zone has been observed to be significantly impeded (Rohay et al. 1994b). Clastic dikes, which cross-cut the generally horizontal sedimentary layers, contain sediments that may be more permeable than the host sediments and enhance vertical migration of contaminants. However, the clay skins that typically line the margins of the dikes may be less permeable and inhibit horizontal migration across the dike margins (Fecht et al. 1999).

The wastewater discharges at cribs and ditches near the carbon tetrachloride disposal sites may have created vertical hydraulic barriers to lateral liquid and vapor migration within the vadose zone. For example, liquid discharges to the 216-Z-1/Z-11/Z-19/Z-20/U-14 ditch system south and east of the disposal sites may have formed a hydraulic "curtain," preventing carbon tetrachloride-laden fluid and vapor migration to the south and east through the locally saturated soil column and thereby driving contaminant migration locally to the north and west. Ponded surface water and perched water may have created horizontal hydraulic barriers for vertical vapor migration. Before the 216-Z-21 Pond was built southeast of the 216-Z-9 site in the 1980's to receive relatively clean storm drain and cooling water, this water was discharged to a low spot on the ground surface on the north and east sides of the 216-Z-9 Trench (this may have been only a short-lived temporary discharge site). Water from the 216-Z-21 Pond is believed to be the source of the perched water encountered at the Plio-Pleistocene unit near the 216-Z-9 Trench at a depth of 28 to 33 m in well 299-W15-216 in 1992 and at a depth of 32.5 to 33.5 m in well 299-W15-220 in 1993 (Rohay et al. 1992, 1993). The 216-Z-21 Pond is 40 m southeast of well 299-W15-216 and received approximately 9.8×10^7 L of water per year until 1995, when liquid discharges to the ground ceased.

Natural recharge from precipitation is estimated to be greater than 100 mm/yr in the carbon tetrachloride disposal area (Fayer and Walters 1995). Recharge from precipitation is higher in the coarse-textured soils with little or no vegetation, as are found in the 200 West Area (Hartman 1999). Natural recharge may be enhanced at the 216-Z-1A Tile Field, which is approximately 1.5 m below grade and was covered with a gravel layer in 1993, although the tile field was covered with a subsurface sheet of 0.05-cm-thick polyethylene in 1964 prior to reactivation. The sheet may focus percolating recharge water to specific vertical migration areas. The top of the 216-Z-9 Trench is 2.5 m lower than the ground surface on its west and south sides.

The uppermost aquifer beneath the 200 West Area is unconfined and lies within an unconsolidated to semi-indurated gravel and sand sequence of the Ringold Formation. The base of the unconfined aquifer is the Ringold lower mud unit. The unconfined aquifer is approximately 66 m thick underlying the carbon tetrachloride disposal sites (Auten and Reynolds 1997). The horizontal hydraulic conductivity in the aquifer ranges from approximately 10^{-3} cm/s to approximately 10^{-6} cm/s. Anisotropy within a sedimentary unit has not been measured at the disposal sites but elsewhere generally ranges from 6:1 to 16:1. The lateral and vertical variability in hydraulic conductivities is illustrated at the carbon tetrachloride disposal site by the production rates of the six pump-and-treat extraction wells, which range from 63 L/min to 310 L/min for similarly completed and configured wells (DOE-RL 1999b). It also appears that hydraulic conductivity decreases with depth in the unconfined aquifer.

The suprabasalt confined aquifer, composed of interbedded sands and gravels of the Ringold Formation, extends from the Ringold lower mud to the top of basalt bedrock. The basalt confined aquifer system is composed of relatively higher conductivity, water-producing interflow/interbed zones separated by lower conductivity basalt flow interiors.

Wastewater discharges since 1943 have created local groundwater water-table mounds; the locations and heights of the mounds have changed as wastewater discharge locations and rates

have changed. The presence of the mounds has affected both the direction of groundwater movement, causing radial flow from the discharge areas, and the rate of groundwater movement, under increased hydraulic gradients. With the cessation of liquid discharges, the elevations of both the regional water table and the local groundwater mounds have been declining, resulting in (1) a concomitant increase in the thickness of the vadose zone, and (2) changes in flow directions and rates that affect the distribution of contaminants in the groundwater and the local definitions of “upgradient” and “downgradient” (DOE-RL 1999a).

In the early years of carbon tetrachloride discharges, the primary groundwater mound occurred north of Z Plant at T Pond, causing southward net flow until the late 1950's. From the late 1950's through the present, the primary groundwater mound influencing flow directions has been at U Pond and its associated ditches and cribs in the southern half of the 200 West Area. All surface liquid discharges were discontinued in 1995 per *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) Milestone M-17 (Ecology et al. 1998). This change was accompanied by an accelerated rate of water table decline in the 200 West Area (DOE-RL 2000). Figure H-2 shows this increased rate of water-level decline starting in 1995 for four TX-TY Tank Farm wells located north of the carbon tetrachloride disposal sites. Since 1995, the rate of water-level decline is re-equilibrating to the regional rate of water-level decline in response to decreasing vadose zone drainage.

The current groundwater flow directions underlying the carbon tetrachloride disposal sites are also influenced by the 200-ZP-1 groundwater pump-and-treat system, which has been operating at full scale since 1996. The current regional hydraulic gradient is low (0.001 m/m) and the current regional groundwater flow rate is low (approximately 0.15 m/day) across the site (DOE-RL 1999b); groundwater flow rates and contaminant movement are expected to continue to slow as the groundwater mound subsides and the regional water table declines. The current rate of water table decline is approximately 0.40 m/yr under the carbon tetrachloride disposal sites (DOE-RL 2002).

The elevation of the unconfined aquifer water table fluctuates up to 0.2 m/day in response to fluctuations in barometric pressure (Rohay et al. 1993). This water table response, which is more typical for a confined aquifer, is related to the presence of the overlying, less permeable Plio-Pleistocene layer, the relatively thick vadose zone, and atmospheric pressure transients that move both through these sediments and into groundwater wells.

Between 1965 and 1977, the net water table rise was approximately 2 m at the 216-Z-9 site; by 1987 (after U Pond discharges were terminated), the water table had declined to a lower elevation than the level measured in 1965 (Rohay and Johnson 1991). As a result, the location of the pre-1965 capillary fringe beneath the disposal sites was gradually covered with 2 m of saturated soils and then later re-exposed to unsaturated conditions. The thickness of the vadose zone also changed as the water table position changed.

Because of past surface liquid discharges (e.g., U Pond) and a resultant elevated groundwater table, hydraulic head decreases with depth in much of the 200 West Area. Vertical groundwater gradients historically have been downward from the unconfined to the confined system, with

hydraulic head differences across the Ringold lower mud becoming more pronounced into the basalt aquifer (Spane and Webber 1995). As the regional water table declines, the head difference between the unconfined aquifer and the lower semi-confined sedimentary units and basalts will become less pronounced. This change should decrease the possibility of dissolved contamination being driven into the lower aquifers. Figure H-3 shows how the hydraulic head differential between the upper and lower aquifers is decreasing near the disposal sites because of the regional water-level decline and the effects of the 200-ZP-1 pump-and-treat operations. Movement of contamination into the deeper aquifer has also occurred in wells open across both the unconfined and confined sedimentary aquifers (Auten and Reynolds 1997). One such well located near the 216-Z-9 Crib, 299-W15-5, was decommissioned in 1997 to prevent contaminant movement from the upper unconfined aquifer to the lower sedimentary aquifers.

H1.3 CARBON TETRACHLORIDE DISTRIBUTION

H1.3.1 Mass Balance Calculations

The original total inventory of carbon tetrachloride discharged to the three primary disposal sites ranged from 577,000 to 922,000 kg (averaging 750,000 kg). After discharge to the soil column, the carbon tetrachloride in the dissolved and nonaqueous liquid phases could partition into soil vapor, soil moisture and groundwater, and sorbed solid phases. Concentrations of carbon tetrachloride measured in groundwater and soil vapor in 1990 prior to remediation were used with equilibrium partitioning relationships to account for approximately 35% of the total carbon tetrachloride inventory discharged to the soil column (WHC 1993) (Table H-4). However, a later laboratory-based study using carbon tetrachloride and site-specific soils concluded that calculation of carbon tetrachloride soil concentrations using measured vapor-phase concentrations and either empirical relationships or adsorption isotherms to estimate the soil partitioning coefficient can lead to significant error (Yonge et al. 1996). In particular, these relationships do not account for the nonequilibrium partitioning of carbon tetrachloride within soil particles (the apparent "irreversible" adsorption). Therefore, the remaining 65% of the original inventory is believed to be in residual saturation and nonequilibrium sorption sites within the vadose zone and groundwater.

Based on the equilibrium partitioning relationships and the 1990 soil vapor data, 12% of the original inventory was estimated to be in the vadose zone: 4% in soil vapor, 2% in soil moisture, and 6% sorbed to solids (WHC 1993). Based on more recent studies, a significant mass of carbon tetrachloride is believed to be in nonequilibrium sorption sites within the vadose zone soils (Cameron 1997). The extent and magnitude of nonequilibrium sorption has not been determined.

Numerical modeling of vadose zone flow and transport at the 216-Z-9 site indicates that 66% to 90% of the carbon tetrachloride discharged to the 216-Z-9 site was retained in the vadose zone, even under the most conservative bounding conditions of very small residual saturation and large source term (Piepho 1996). In this model, the term "residual saturation" refers to the immovable carbon tetrachloride liquid, including sorbed and entrapped phases. Because the natural organic

carbon content in the soils is very small, low values (0.01 and 0.0001) of residual saturation were used in the simulations (Piepho 1996). Larger values of residual saturation would have resulted in less carbon tetrachloride transport to groundwater. The results of this modeling indicate that the rate and amount of carbon tetrachloride transport to groundwater is sensitive to the value of residual saturation assumed for the vadose zone and groundwater.

Evaporation and barometric pumping of carbon tetrachloride is estimated to have removed 21% of the original carbon tetrachloride inventory from the vadose zone between 1955 and 1990 (WHC 1993).

The concentrations of chloroform observed in the vadose zone and groundwater could be produced by reductive dechlorination of 1% of the carbon tetrachloride discharged to the soil column (Hooker et al. 1996). Based on the mass of the carbon source, (lard oil and butyl phosphates) and nitrate (electron acceptor) co-disposed with the carbon tetrachloride, Hooker et al. (1996) estimated that 1% of the carbon tetrachloride could have been transformed to chloroform by microbial dechlorination during initial discharge stages. Biodegradation is probably no longer occurring within the vadose zone and groundwater because the naturally occurring total organic carbon in the soil is insufficient to fuel the process (Truex et al. 2001). In addition, the aerobic condition of the Hanford vadose zone and groundwater do not favor biodegradation of carbon tetrachloride, which occurs under predominantly anaerobic conditions (Truex et al. 2001).

Carbon tetrachloride may also degrade through aqueous hydrolysis, an abiotic process. The likely range of abiotic hydrolysis rates corresponds to a carbon tetrachloride half-life of between 36 and 290 years in the aquifer at the Hanford Site; the best estimate for the half-life would be approximately 100 years (Truex et al. 2001). Truex et al. (2001) believe that aqueous hydrolysis of carbon tetrachloride probably produces carbon dioxide and hydrochloric acid but no hazardous compounds; however, they caution that the reaction products may need to be confirmed with site-specific testing.

The mass of carbon tetrachloride in the upper 10 m of the unconfined aquifer in 1990 was estimated to be 5,250 to 15,740 kg, accounting for 1% to 2% of the original inventory, depending on the value of porosity assumed (Rohay and Johnson 1991) (Table H-5a). The mass of carbon tetrachloride in the aquifer calculated using the smoothed 1996 groundwater contours for comparable conditions (i.e., 10-m aquifer thickness, 30% porosity, no sorption) was 12,203 kg, also accounting for 1% to 2% of the original inventory (Table H-5b). For the 1990 estimate, a soil partitioning distribution coefficient (K_d) of 0.2 mL/g would result in an additional 2% to 8% of the carbon tetrachloride inventory sorbed to aquifer solids (Rohay et al. 1994a). The 1996 calculations evaluated the effect of two different K_d values (0.05 mL/g and 0.114 mL/g) for partitioning carbon tetrachloride between water and solid phases (Table H-5b).

Approximately 82,970 kg of carbon tetrachloride have been removed from the subsurface (vadose zone and groundwater) since remediation of the site began with the soil vapor extraction (SVE) system pilot test in 1991. Between April 1991 and September 2001, SVE removed approximately 77,150 kg of carbon tetrachloride from the vadose zone (Table 4-1). Between

August 1994 and September 2001, pump and treat (200-UP-1 and 200-ZP-1) removed about 5,820 kg from the unconfined aquifer (DOE-RL 2002).

H1.3.2 Distribution Within Atmosphere

Global background air concentrations of carbon tetrachloride are approximately 0.15 ppb (Shaw et al. 1996).

H1.3.3 Distribution Within Vadose Zone

Carbon tetrachloride is found throughout the vadose zone within the approximately 0.2-km² source area. Laterally, the highest concentrations of carbon tetrachloride historically have been located in the vicinity of the 216-Z-9 Trench. Vertically, the highest concentrations are associated with the finer grained, relatively less permeable units (the Hanford lower fine and Plio-Pleistocene units).

The highest near-surface vapor concentration measured during a soil-vapor survey prior to remediation was 72 ppmv carbon tetrachloride just north of the 216-Z-9 Trench (Rohay et al. 1992). Maximum vapor concentrations observed at wellheads and deep soil vapor probes, which were measured twice a week for 25 months from 1991 through 1993, exceeded an estimated 10,000 ppmv (the instrument was calibrated up to 2,000 ppmv) total volatile organic compounds at monitoring locations above the Plio-Pleistocene unit and immediately north of the 216-Z-9 Trench (Fancher 1994). At similar depth intervals above the Plio-Pleistocene unit in the 216-Z-1A/Z-18/Z-12 area, maximum concentrations were an order of magnitude lower. However, maximum concentrations from monitoring ports below the Plio-Pleistocene unit were approximately 1,000 ppmv at both the 216-Z-9 and 216-Z-1A/Z-18/Z-12 locations (Fancher 1994).

The highest carbon tetrachloride concentration in the sediment samples collected during drilling of 13 new wells in 1992 and 1993 was 37.8 ppm from a well at the 216-Z-9 Trench (Rohay et al. 1994a). Carbon tetrachloride concentrations exceeded 10 ppm in samples from two other wells in the 216-Z-9 area. In contrast, the highest carbon tetrachloride concentration in a sediment sample from the 216-Z-1A/Z-18 area was 6.6 ppm from a well inside the 216-Z-1A Tile Field. At both locations, the maximum carbon tetrachloride sediment concentration in each well is associated with the interbedded sands and silts of the Hanford formation lower fine unit, laminated silts of the Plio-Pleistocene unit, and/or the top of the caliche.

The highest carbon tetrachloride concentrations in the in situ soil vapor samples collected during drilling were 17,000 to 21,000 ppmv from the Plio-Pleistocene unit in a well at the 216-Z-9 Trench and 10,000 ppmv from the same well at the capillary fringe; the highest in situ soil vapor sample measured from a 216-Z-1A/Z-18 well was 1,400 ppmv (Rohay 1997). Maximum carbon tetrachloride concentrations in soil vapor extracted using the SVE systems were approximately 30,000 ppmv from intervals above the Plio-Pleistocene unit at the 216-Z-9 Trench and 1,500 ppmv from intervals above the Plio-Pleistocene unit at the 216-Z-1A/Z-18 site.

Soil that is saturated with liquid carbon tetrachloride will have an associated equilibrium soil vapor concentration of 120,000 ppmv at 20 °C (Rohay and Johnson 1991). As a rule-of-thumb, for soils saturated with an organic contaminant, standard SVE will produce a gas stream containing one-tenth to one-half the equilibrium soil vapor concentration (Johnson 1993a). Therefore, vapor extraction concentrations greater than 12,000 ppmv of carbon tetrachloride may indicate that the soil near the extraction well is saturated with a nonaqueous-phase liquid. Initial soil vapor concentrations extracted from the 216-Z-9 site were approximately 30,000 ppmv, suggesting that a carbon tetrachloride DNAPL was present above the Plio-Pleistocene layer prior to remediation. The high in situ soil vapor concentrations of 17,000 to 21,000 ppmv observed prior to remediation during drilling also suggest the presence of DNAPL at the 216-Z-9 site.

The high vapor concentration (>10,000 ppmv) observed in the in situ soil vapor sample collected at the capillary fringe at the 216-Z-9 site prior to SVE remediation suggests that DNAPL reached the capillary fringe. The DNAPL will accumulate at the capillary fringe until it develops sufficient head that it can flow through (overcome entry pressure) into the aquifer (Pankow and Cherry 1996).

The high carbon tetrachloride concentrations measured during baseline monitoring from 1991 through 1993 prior to remediation may also suggest the presence of DNAPL. As a rule-of-thumb, "full-scale OVA readings of 1,000 to 2,000 ppmv are probably a reasonable indication of the presence of DNAPL when the DNAPL is comprised of one or more chlorinated solvent" (Pankow and Cherry 1996, p. 416). Fancher (1994) recorded maximum organic vapor analyzer (OVA) measurements of approximately 1,000 ppmv at the 216-Z-1A/Z-18/Z-12 site and exceeding 2,000 ppmv at the 216-Z-9 site, above the lower permeability Plio-Pleistocene layer, and maximum OVA measurements of approximately 1,000 ppmv at the 216-Z-1A/Z-18/Z-12 and 216-Z-9 sites below the Plio-Pleistocene layer.

Nonaqueous-phase liquid carbon tetrachloride has not been observed in the vadose zone.

The locations of the maximum carbon tetrachloride rebound in the vadose zone following SVE operations were the same in 1997, 1998, 1999, 2000, and 2001. The persistence of these rebound locations may indicate nearby locations of DNAPL and/or residual carbon tetrachloride. The 1997 rebound study and 1998, 1999, 2000, and 2001 monitoring indicated that at most locations within the influence of the SVE systems, much of the readily available carbon tetrachloride has been removed. The lower permeability Plio-Pleistocene layer, however, appears to be a continuing source of carbon tetrachloride soil vapor (Rohay 1997, Section 6.0 of this report). The SVE system is able to draw air through the higher permeability sands and gravels but not effectively through the lower permeability silts and carbonate-cemented sandy gravel of the Hanford lower fine and Plio-Pleistocene units.

The spacing and various open intervals of the current SVE extraction and monitoring wells do not provide full coverage of the contaminated vadose zone in the disposal site area. Thus, some readily available carbon tetrachloride contaminant in relatively permeable sediments may still remain in the vadose zone soils that are not currently impacted by the SVE system operations (Cameron 1997, Rohay 1997).

The limited number of monitoring locations, especially below the Plio-Pleistocene layer, and difficulty in predicting contaminant migration pathways from the surface disposal sites contribute to the uncertainty in describing the overall contaminant distribution in the vadose zone.

In the far field, carbon tetrachloride vapor has been detected in wells under construction throughout much of the 200 West Area since 1987 (Rohay and Johnson 1991, Rohay et. al. 1992). Most of the reported detections have been from below the Plio-Pleistocene layer, often in the capillary fringe just above the water table. The distribution of wells with detections below the Plio-Pleistocene layer matches fairly well with the distribution of carbon tetrachloride dissolved in the groundwater, suggesting that the source of the vapor may be volatilization from groundwater. However, some wells, notably those approximately 300 m west of the 216-Z-18/Z-12 disposal sites, also had detections above the Plio-Pleistocene layer, suggesting that carbon tetrachloride may have migrated laterally west from the disposal sites or east from the 218-W-4C Burial Grounds. (These detections of carbon tetrachloride occurred prior to vadose zone remediation using SVE.)

Plutonium and americium co-contaminants are distributed within the upper 30 m of the vadose zone (20 to 30 m below crib bottom), based on characterization of the 216-Z-1A Tile Field in 1976 (Price et al. 1977). The transuranic (TRU) contamination at the carbon tetrachloride sites may have been carried downward through a combination of acidic waste liquids and organic-complexant mixtures (Price et al. 1979, Johnson and Hodges 1997). After the disposal occurred, both the acidic and organic complexes are expected to diminish via soil pH neutralization and biodegradation processes, and plutonium and americium would be expected to absorb strongly to the Hanford site sediments (Hartman 1999).

H1.3.4 Distribution Within Groundwater

In FY 2001, the plume of dissolved carbon tetrachloride extended over 11 km² in the unconfined aquifer underlying the 200 West Area (Hartman et al. 2002) (Figure H-4). It has been previously concluded that because the zone of highest concentrations (4,000 to 8,000 µg/L) has in the past included the 216-Z-9 Trench, carbon tetrachloride discharged to the trench may be providing a continuous source of contamination to groundwater (Rohay et al. 1994). However, recent concentrations have been decreasing at 200-ZP-1 pump-and-treat extraction well 299-W15-32 (Figure H-5) located at the northeast corner of the trench. The observed decrease suggests that either the carbon tetrachloride in the vadose zone (or DNAPL in the aquifer) is not currently a continuing source or that the rate of mass removal by groundwater extraction exceeds the rate of mass contribution from the vadose zone (or aquifer).

Concentrations at well 299-W15-32 were observed to increase following the extended shutdown of this well from June 29, 1999 to February 2, 2000 (Figure H-5). If the vadose zone is a continuing source of carbon tetrachloride to the groundwater, or if DNAPL is present in groundwater, it would be expected that some rebound would have occurred during the shutdown. Conversely, if there were no continuing source, dissolved concentrations would have been

expected to remain at about the same concentration during and following shutdown. The overall increase could be interpreted to mean that:

- A source of residual carbon tetrachloride continues to contribute to groundwater from the vadose zone.
- A source of residual DNAPL is present below the water table.
- Both vadose zone and groundwater sources are contributing.
- Dissolution of residual DNAPL, in either a vadose source and/or in groundwater, is slow compared to the pumping-induced groundwater velocity across the site so overall groundwater concentrations tend to decline during pumping.

The first few carbon tetrachloride measurements following shutdown appear to be on the same declining trend exhibited prior to shutdown (Figure H-5). Then concentrations at the extraction well increase to pre-shutdown levels. The delay in increased concentrations observed at the extraction well may indicate that the source is at some distance from the well and that groundwater had to travel from the source to the well before the increase could be observed. Based on Darcy's Law, the source would be 8.5 m (28 ft) from the well, assuming:

- The time required for the groundwater to travel from the source to the well was 57 days (February 2, 2000 to March 30, 2000)
- The hydraulic conductivity is 15 m/d (DOE-RL 1999b)
- The hydraulic gradient is 0.001 m/m (DOE-RL 1999b)
- The effective porosity is 10% (conservative estimate) (DOE-RL 1999b).

Well 299-W15-32 is 7.4 m from the northeast corner of 216-Z-9 and 26.3 m from well 299-W15-218, where high concentrations were observed at the capillary fringe during drilling in 1993.

It is interesting to note that the declining concentration trends prior to shutdown and following the increase after shutdown are the same.

At some time in the future, tailing of groundwater concentrations is expected to occur as carbon tetrachloride is removed from the more permeable zones and becomes diffusion limited moving from the less permeable zones. Tailing should occur even if carbon tetrachloride is present as dissolved phase, as residual DNAPL, as a vadose zone source, or from a combination of these factors. There are not enough data at this time to determine which of these conditions is present (other than the dissolved phase). Previous modeling work by Piepho (1996) implied that residual DNAPL should be present beneath the water table.

Although the centroid of the plume has not migrated significantly under natural driving forces, the perimeter of the plume appears to be migrating laterally to the south and northeast (Hartman et al. 2002). Dissolved concentrations measured in well 699-39-79 at the western perimeter of the plume increased by an order of magnitude between March 1987 and August 1988, suggesting the arrival of the plume at that time (Dresel et al. 1993). Concentrations of carbon tetrachloride at well 699-39-79 have declined since 1996 to below maximum contaminant levels because clean groundwater has been injected at nearby well 299-W15-29 (Figure H-4).

Based on dissolved-phase concentrations in the upper 10 m of the unconfined aquifer in 1990, and prior to remediation, nearly 60% of the groundwater mass of carbon tetrachloride was estimated to be contained within about 10% of the area of the plume (Rohay and Johnson 1991) (Table H-5a). The centroid of the plume is apparently being displaced in response to remediation operations, with the dissolved phase moving most notably toward the three northern extraction wells (Figure H-6). It is recommended that the total mass in the centroid be recalculated, compared to the original estimates, and used to estimate remediation time using pump-and-treat technology.

The shape and location of the groundwater plume for the high-concentration area ($>4,000 \mu\text{g/L}$) lends itself to at least three explanations or possible combinations of these explanations (Figure H-6). First, the location of the high-concentration area northwest of the 216-Z-9 disposal site implies that the groundwater mound created at the U Pond and other nearby disposal facilities produced a hydraulic flow field that moved contamination this direction. Recreating the development of the mound and disposal and migration of carbon tetrachloride contamination using a numerical computer model or other analytical tools would help confirm and quantify this type of movement.

It should be noted that the groundwater plume map for 1996, prior to substantial remediation efforts, may not truly represent the baseline plume shape at that time because of the lack of monitoring locations northwest of 216-Z-9 between wells 299-W15-32 and 299-W25-31A. The centroid of the plume may in fact be located closer to 216-Z-9, beneath the Z Plant surface facilities. If this is correct, then the highest groundwater concentrations have been or would be beneath Z Plant. This explanation is supported by the increasingly high concentrations measured at wells 299-W15-31A (from $3,260 \mu\text{g/L}$ in 1996 to $6,500 \mu\text{g/L}$ in 1999) and 299-W15-1 ($1,180 \mu\text{g/L}$ to about $6,350 \mu\text{g/L}$ in 1999). Both of these wells are in the induced flow path under Z Plant to extraction wells 299-W15-33 and 299-W15-34 (Figure H-6).

A second possible explanation for the current shape of the groundwater plume is that carbon tetrachloride contamination was directed to the northwest by relatively continuous lower permeability sediment units, particularly the Plio-Pleistocene unit. This unit would be a prime candidate for this explanation, but is thought to dip to the south in the area of the disposal sites based on regional geologic information. However, recent surface geophysics work by the University of South Carolina (Temples et al. 2001) suggests that the DNAPL discharged to the 216-Z-9 Trench would flow to the north and northeast. This latest information therefore supports the idea that carbon tetrachloride may have moved to the north, and then migrated through the Plio-Pleistocene unit to the groundwater.

A third possible explanation for the distribution pattern of the groundwater plume is that one or more additional, as yet undocumented, sources of carbon tetrachloride may have contributed to groundwater contamination in this area. The highest groundwater concentrations have been measured not only beneath the 216-Z-9 Trench, which is a known source, but also in the area northwest of Z Plant, where no sources are documented. Possible sources of carbon tetrachloride contamination in the groundwater northwest of Z Plant could include the following:

- Discharges of carbon tetrachloride to the 216-Z-12 Crib at volumes higher than originally estimated (Kasper 1982)
- Leakage of carbon tetrachloride liquids from the 216-Z-12 head end pipe
- Releases of carbon tetrachloride from wastes in the burial grounds west of Z Plant
- Other, as yet undocumented sources of carbon tetrachloride from soil column disposal within or near Z Plant (e.g., may be associated with railroad operations).

The 216-Z-7 Crib east of the 231-Z Building (Figure 2-1) may also be a potential source of carbon tetrachloride contamination. Continuous measurements of carbon tetrachloride concentrations in air for 87 days in 1995 at a monitoring station north of the 216-Z-9 site indicated that the 216-Z-7 Crib was a source of the carbon tetrachloride (Shaw et al. 1996). At this monitoring station, an air sample was drawn alternately from each of two heights (0.88 and 2.65 m) every 10 minutes and analyzed for carbon tetrachloride concentrations as part of a determination of carbon tetrachloride flux to the atmosphere. The concentrations were compared to wind directions at the time of sampling to identify locations of carbon tetrachloride sources.

The source of the secondary maximum in groundwater near the T-TX-TY Tank Farms and T Plant is unknown (Figure H-4). One hypothesis is that the carbon tetrachloride migrated from the 216-Z-9 area, i.e., it was hydraulically driven north because of mounding at U Pond. There may have been another source of carbon tetrachloride near T Plant. Carbon tetrachloride discharges to the 216-T-19 Crib may have contributed to this portion of the groundwater plume. A computer modeling effort would help evaluate the reasonableness of these hypotheses.

The source of the low-concentration lobe of the carbon tetrachloride plume southwest of the former U Pond is also uncertain (Figure H-4). If the source of this contamination were from early years of carbon tetrachloride disposal, when the groundwater flow was to the south, and if concentrations were much higher at that time, the low concentrations might reflect displacement and dilution by the large volume of U Pond discharges. However, if concentrations were not much higher originally, the U Pond discharges presumably should have displaced or diluted this hypothetical early plume. Contamination in this part of the aquifer may be a result of vapor transport from the source cribs or vapor cycling (carbon tetrachloride volatilizing from contaminated groundwater, diffusing through the vadose zone, and then contaminating clean groundwater).

Carbon tetrachloride has been detected at or less than 1% of its theoretical solubility limit in water (800,000 $\mu\text{g/L}$). Dissolved concentrations of DNAPLs in groundwater are commonly observed to be significantly below their aqueous solubility limits, even when the aquifer is believed to contain separate phase liquid (Anderson et al. 1992). Possible explanations proposed by Anderson et al. (1992) include the preferential formation of horizontal pools of DNAPL as a result of lateral spreading, which would reduce the cross-sectional contact area with groundwater; dilution by dispersion; and dilution in monitoring wells screened over lengths that are large relative to the dimensions of the plume. In addition, most 200 West Area wells monitor the top of the aquifer and may not sample carbon tetrachloride present at depth. In the 200 West Area, the wells are sampling an increasingly smaller portion of the top of the unconfined aquifer as the water table elevation declines.

As a rule-of-thumb, “dissolved concentrations that exceed 1% of the effective solubility should probably be cause for serious consideration of the presence of a DNAPL phase” (Pankow and Cherry 1996, p. 222-223). Dissolved concentrations of approximately 8,000 $\mu\text{g/L}$ were observed at an extraction well (299-W15-32) adjacent to the 216-Z-9 Trench during initial pumping, which intermixed the dissolved concentrations with cleaner groundwater. Numerical modeling of vadose zone flow and transport at the 216-Z-9 site indicates that liquid carbon tetrachloride reached the aquifer at that location (Piepho 1996). Prior to remediation, the continuing presence of relatively high dissolved concentrations in groundwater in the immediate vicinity of the 216-Z-9 Trench had suggested that a DNAPL was slowly dissolving within the aquifer or continuing to migrate from the vadose zone. However, as discussed previously, declining groundwater concentrations at extraction well 299-W15-32 would seem to make DNAPL a less significant contributor of contamination than the dissolved phase. If, as the numerical modeling suggests, carbon tetrachloride reached the aquifer in the first 7 years of discharge and ponded at the capillary fringe present in 1962, the carbon tetrachloride may have been trapped and dissolving while it was buried for 25 years within the saturated zone as a result of the elevated water table from 1965 to 1987. The relatively low carbon tetrachloride vapor concentrations currently observed near the water table do not indicate the presence of DNAPL sources near the monitoring locations.

Historically, the highest carbon tetrachloride concentrations detected during groundwater monitoring were in samples from well 299-W15-16. The carbon tetrachloride concentration in groundwater from this well was 8,100 $\mu\text{g/L}$ when it was first sampled in 1988 and reached a maximum of 8,700 $\mu\text{g/L}$ in 1990 (Evans et al. 1992). Well 299-W15-16 located northwest of Z Plant is not near a known source of carbon tetrachloride.

The rebound of carbon tetrachloride concentrations in groundwater following pump-and-treat operations might indicate the presence of DNAPL. While concentrations are generally increasing or stable at the three northern extraction wells and the plume is moving toward these wells, a large-scale rebound test has not been conducted. An 8-month period of shutdown at extraction well 299-W15-32 did show what appears to be rebound. Initially, concentrations continued to decrease, but later displayed a relatively sharp increase (Figure H-5). This slightly delayed increase implies some contributing source approximately 8.5 m from the extraction well or diffusion of carbon tetrachloride out of lower permeability zones.

The estimated change in location of the 4,000- $\mu\text{g/L}$ contour from southwest of Z Plant to beneath Z Plant after 4 years of pump-and-treat operations implies either that DNAPL may not be present in the aquifer southwest of Z Plant or that the rate of dissolution of residual DNAPL in groundwater is slow compared to the pumping-induced groundwater velocity in this area (Figure H-6). At the least it indicates that the dissolved phase is the dominant contaminant form in this area at the current concentration levels. At some lower concentration, another phase may dominate (e.g., dissolution of residual DNAPL). This change in shape/position can be explained by changes in the hydraulic flow field produced by the groundwater extraction and injection wells (DOE-RL 2000).

The mass of carbon tetrachloride dissolved in the aqueous wastewater discharges to the soil column was estimated to be 10,560 kg ($13.2 \times 10^6 \text{ L} \times 800,000 \mu\text{g/L}$ at solubility limit $\times 1 \text{ kg}/10^9 \mu\text{g} = 10,560 \text{ kg}$) (Rohay and Johnson 1991). This value is the same order of magnitude as the inventory calculated for the upper 10 m of the aquifer (5,250 to 15,740 kg) (Table H-5a). Thus, solely aqueous-phase carbon tetrachloride could be the primary source of groundwater contamination; a DNAPL source would not be required to produce the groundwater inventory in the upper 10 m, assuming no sorption of carbon tetrachloride to aquifer solids. (This calculation assumes that the total volume of liquid discharged to each site was all aqueous phase containing carbon tetrachloride at its solubility limit and that all the liquid discharged reached groundwater. These quantities of carbon tetrachloride -- Z-9 = 3,300 kg; Z-1A = 4,200 kg; Z-18 = 3,100 kg -- represent approximately 2% of the carbon tetrachloride discharged to these sites.)

DNAPL has never been observed directly in groundwater. The probability of recovering residual DNAPL during drilling and sampling is very low because of its tendency to remain in the sediment pore spaces even adjacent to open wells or well screens. The possibility of recovering residual DNAPL is not very likely given the relatively small number of groundwater wells installed in the disposal areas. There is a higher likelihood of finding DNAPL in the vadose zone, because of the higher well density. However, DNAPL has never been detected in the vadose zone, either.

Numerical modeling of vadose zone flow and transport indicates that at lower residual saturation values, dissolved and nonaqueous-phase liquid carbon tetrachloride can penetrate deeply into the unconfined aquifer, but likely would not have reached the bottom of the aquifer (Piepho 1996). The depth of penetration depends on the level of residual saturation assumed for the vadose zone and the groundwater flow rate.

Dissolved carbon tetrachloride has been observed deep within the unconfined aquifer (i.e., between 10 m below the water table and the base of the unconfined aquifer) at the following locations:

- 216-Z-9 site (wells 299-W15-6 and 299-W15-5) (Rohay and Johnson 1991, Auten and Reynolds 1997)
- West and north of Z Plant (wells 299-W15-17, 299-W15-7, 299-W15-10, 299-W10-22, 299-W14-14, 299-W10-24, 299-W15-25, and 299-W15-30) (Hartman 1999; BHI 1997, 1998; Swanson et al. 1999)
- Near U Plant (wells 299-W19-34A, 299-W19-34B, 299-W19-18, and 299-W19-4) (Ford 1995)
- Near T Plant (well 299-W11-32) (Newcomer et al. 1995).

Dissolved carbon tetrachloride has also been observed within the confined aquifer system (i.e., in the gravels below base of unconfined aquifer) at wells at the following locations:

- South of the 216-Z-9 site (well 299-W15-5; well probably served as preferential pathway) (Auten and Reynolds 1997)
- East of the 216-Z-9 site (well 299-W14-9) (DOE-RL 1999b)
- Near the T-TY-TX Tank Farms (wells 299-W10-24 and 299-W14-14) (Hartman 1999)
- Near U Plant (well 299-W19-34B) (Ford 1995).

The observed distribution of dissolved carbon tetrachloride in the high-concentration portion of the groundwater plume is inconsistent with a vapor-phase source. A vapor-phase source should result in a shallow (1- to 2-m thick) vertical distribution in the aquifer due to the relatively slow process of molecular diffusion, the process by which the carbon tetrachloride vapor enters the groundwater (Pinder and Abriola 1986). However, carbon tetrachloride contamination is found at depths greater than 30 m below the water table.

The 200-ZP-1 groundwater pump-and-treat system is containing carbon tetrachloride within the 2,000- $\mu\text{g/L}$ contour (DOE-RL 2002). Between August 1994 and September 2001, this system has removed about 5,800 kg of carbon tetrachloride, which is 91% to 274% of the mass initially estimated in 1990 to be contained within the 2,000- $\mu\text{g/L}$ contour (Table H-5). The persistence of the carbon tetrachloride concentrations implies that the initial mass calculation was incorrect (e.g., because of greater depth distribution), that the K_d is greater than assumed, and/or possibly the presence of a continuing source of carbon tetrachloride (residual or DNAPL). A revised estimate of carbon tetrachloride mass is needed.

Low (<10 pCi/L) plutonium-239/240 and americium-241 activities were detected in well 299-W15-8 adjacent to the 216-Z-9 Trench on two sampling dates (May 7, 1990 and November 13, 1991). The well went dry sometime after January 1992 and can no longer be sampled (Hartman 1999). The plutonium and americium contamination observed in groundwater at the 216-Z-9 site in well 299-W15-8 may signify soil column breakthrough or a preferential pathway in the well. Followup sampling of groundwater extracted by the pump-and-treat system at 216-Z-9 did not detect mobile species indicative of TRU (Hartman 1999). "Extraction well 299-W15-32, located next to the 216-Z-9 Trench, has been sampled for plutonium isotopes for the last several years and for neptunium-237 and americium-241 in FY 1998, without detecting any plutonium, neptunium, or americium. However, because this well draws water from a considerable area, the samples may not be representative of contaminant activities directly under the trench" (Hartman 1999).

Radionuclide sampling for technetium-99, tritium, and iodine-129 at the 200-ZP-1 treatment system revealed elevated levels of technetium-99 at extraction wells 299-W15-32 and 299-W15-35 in FY 1999 (DOE-RL 2000). Concentrations were 286 pCi/L and about 200 pCi/L, respectively. Results for tritium in the northern three extraction wells ranged from 2,160 to 4,450 pCi/L, and were non-detect for iodine-129. The elevated technetium-99 results imply that either this contaminant is moving from the plume associated with the TX-TY Tank Farm to the north, or is coming from some other source. Historically, some technetium-99 was detected near the 216-Z-9 Trench (410 pCi/L in 1992 at well 299-W15-8).

H1.4 CARBON TETRACHLORIDE TRANSPORT

H1.4.1 Vadose Zone/Atmosphere Interface

Atmospheric pressure fluctuations appear to constitute a significant release mechanism for carbon tetrachloride vapor out of the vadose zone both through the soil surface and through boreholes perforated or otherwise open to the vadose zone. The soil-surface flux of carbon tetrachloride measured at the ground surface in the vicinity of the 216-Z-9 site in 1992 and 1993 using the EMFLUX® (Quadrel Services, Inc.) soil vapor technology ranged from 0 to 923 ng/m²/min (0 to 485 kg/yr for a 1-km² area) (Rohay et al. 1994a). The average soil-surface flux for the area overlying the groundwater plume in 1990 was estimated to be 285 ng/m²/min, or 1,800 kg/yr, assuming carbon tetrachloride partitions from groundwater according to Henry's Law, diffuses from groundwater to 1 m below ground surface, and then is barometrically swept out (WHC 1993). The 1994-1995 flux of carbon tetrachloride to the atmosphere from a 1-km² area that includes the carbon tetrachloride discharge sites was 1,200 kg/yr, based on site-specific mass balance and tracer-ratio measurements (includes soil and wells) (Shaw et al. 1996).

It is estimated that, between 1955 and 1990, 18% of the total carbon tetrachloride inventory was lost to the atmosphere through natural soil flux at the ground surface (WHC 1993). The depth over which carbon tetrachloride is removed by barometric pumping was estimated in 1992 to be 1 m (WHC 1993). In 1992, barometric pressure fluctuations averaged 1.4% of the average barometric pressure. Assuming that a 1.4% pressure increase results in a 1.4% volume decrease

in the soil vapor, on an annually averaged basis barometric pumping would sweep out air in the pores of the top 1.4% of the vadose zone (1.4% of 64 m) half of the time.

The 2-m rise of the water table between 1965 and 1977 would have displaced contaminated soil vapor from the vadose zone to the atmosphere. This effect was not included in the 1990 estimates of vadose zone losses.

The wells “breathe” in response to atmospheric pressure changes and other meteorological phenomena. The carbon tetrachloride released from wells in the vicinity of the cribs between 1955 and 1990 was estimated to be 22,200 kg, or 3% of the discharged inventory (WHC 1993). Thus, an estimated 21% of the total carbon tetrachloride inventory may have been lost to the atmosphere via the soil surface and borehole flux since soil column disposal was initiated (WHC 1993).

H1.4.2 Vadose Zone

Once discharged to the crib, the liquid wastes infiltrated into the underlying soils and migrated predominantly downward. An average infiltration rate or recharge rate into the soil column can be estimated for each crib from the area of the crib bottom and average annual discharges. These range from 1 to 10 L/m²/day (Table H-6). Average infiltration rates from percolation tests in the 216-Z-20 and 216-Z-21 Crib areas have been reported as ranging from 1,900 to 2,850 L/m²/day (Last and Rohay 1993). Thus, the field-measured infiltration rate of the soil column far exceeds the estimated recharge rate from the cribs. Assuming that the behavior of the liquid wastes discharged was similar to that of water used in the percolation tests, it is doubtful that the soil column ever became fully saturated or that the cribs exceeded the infiltration capacity, at least for any appreciable period of time. Crawley (1969), however, did report that a buildup of liquid waste was suspected in the head end of the 216-Z-1A Tile Field. This suggests that the infiltration capacity of the first one-third of the crib had been exceeded by the discharge volumes, perhaps as a result of plugging of the soil pores by fine particulates or other solids. It should also be noted that the 216-Z-1A Tile Field had received other liquid wastes from 1949 to 1959, so the soil column was already partially saturated.

As a first approximation, the likelihood that carbon tetrachloride in an aqueous or nonaqueous phase reached the groundwater can be estimated by comparing the total volume discharged to the column pore volume beneath each crib (i.e., bottom area of the crib multiplied by depth to water multiplied by porosity, assuming 30% porosity). Results of such calculations indicate that the 216-Z-1A and 216-Z-18 waste disposal facilities received only 12% and 29% of their estimated column pore volumes, respectively, while the 216-Z-9 Trench received 142% of its column pore volume (Table H-6). It must be noted that these are only rough estimates and that the wastes were discharged over periods of years rather than at one time. Additional drainage would also have occurred under unsaturated conditions, after discharges were terminated. If the porosity were smaller or if the entire column pore volume were not used (e.g., if the wastes migrated down preferential pathways such as unsealed wells or if the wastes did not spread out evenly over the crib floor), the values would be higher. Conversely, if the waste plume spread out laterally, increasing its column pore volume, these values would be smaller. In any case, the

216-Z-9 Trench is more likely to have had waste fluids containing carbon tetrachloride reach the groundwater strictly by downward percolation.

Numerical modeling of vadose zone flow and transport indicates that both dissolved and nonaqueous-phase liquid carbon tetrachloride migrated through the vadose zone and reached the unconfined aquifer below the 216-Z-9 Trench (Piepho 1996). In the simulations, the flux of carbon tetrachloride from the vadose zone into the aquifer primarily depends on the amount of carbon tetrachloride held in residual saturation in the vadose zone (Piepho 1996). However, for both values (0.01 and 0.0001) of residual saturation used in the simulations, the numerical modeling results indicate that carbon tetrachloride continues to enter the aquifer for a long time (at least 38 years and likely for longer in the simulations) after the initial discharge to surface disposal sites (Piepho 1996). In addition to assuming potential values for residual saturation, several simplifications were applied and the physical properties of pure carbon tetrachloride were used rather than those of the carbon tetrachloride organic mixtures.

Numerical simulations of wastewater migration beneath the 216-Z-9 Trench suggest some horizontal spreading of the aqueous plume may have occurred at the Hanford coarse-grained unit/fine-grained unit boundary, but that little lateral spreading may have occurred below that (Last and Rohay 1993). Piepho (1996) indicates that greatest horizontal spreading of the aqueous phase in the vadose zone appears to be in the Plio-Pleistocene unit; in these numerical simulations, the ratio of the horizontal to vertical saturated hydraulic conductivity was 10. In these simulations, there is essentially no lateral spreading of the liquid carbon tetrachloride phase (Piepho 1996). Wright et al. (1994) inferred a near-vertical moisture plume beneath the carbon tetrachloride cribs, with some spreading occurring only on the Hanford formation lower fine/Plio-Pleistocene unit surfaces. Field measurements indicate that the lateral spread of radionuclides beyond the perimeter of the 216-Z-1A Tile Field was limited to a 9-m-wide zone (Price et al. 1979), suggesting that the spread of waste liquids was minimal or that the plutonium was filtered in that distance. In conclusion, the aqueous-phase carbon tetrachloride infiltrates predominantly downward from the near-surface discharge sites; any lateral spreading is primarily associated with coarse/fine layer contacts.

Because liquid carbon tetrachloride is relatively immiscible in water and the soil column is assumed to be water-wetted, the carbon tetrachloride would move under its own hydraulic gradient. Wright et al. (1994) concluded, based on their measurements, that the hydraulic conductivity of liquid carbon tetrachloride through the subsurface soil samples was much higher than that of water or of an aqueous carbon tetrachloride solution, and that the differences were greater in the finer grained sample.

As nonaqueous-phase liquid carbon tetrachloride moves down through the soil column, some of the liquid carbon tetrachloride will become discontinuous and will be held in the soil pores as residual saturation. Based on studies of carbon tetrachloride hydraulic conductivities in soil samples, Conca et al. (1992) concluded that the retention of liquid-phase carbon tetrachloride was about half that of water or an aqueous-phase carbon tetrachloride solution. Thus, if the field moisture content of the soil were 5% under a given unsaturated flow condition, it can be estimated to retain 2.5% carbon tetrachloride under the same conditions. It should be noted that

these are strictly empirically derived estimates, based on two samples, and should be viewed with some caution (Rohay et al. 1994). In addition to immobilization by capillary forces, some of the discharged carbon tetrachloride was retained in the vadose zone through mechanisms such as equilibrium (reversible) and nonequilibrium (nonreversible) sorption to soil and entrapment of DNAPL/dissolved liquids in dead-end pore spaces. Through all these mechanisms, residual saturation of contaminated aqueous-phase and nonaqueous-phase liquids will be left along the contaminant migration path.

A rough estimate of how far the organic nonaqueous-phase liquid may have traveled downward through the soil column as a continuous organic liquid phase (i.e., at saturations greater than the residual) can be calculated by assuming a single residual saturation of 2.5% for the entire pore column volume and by assuming that the organic was evenly distributed across the crib bottom area. Table H-7 lists the relative depth of nonaqueous-phase liquid migration for each facility. Note that the migration depth calculated for the 216-Z-9 Trench is over an order of magnitude greater than that of the other two cribs and is potentially below the water table. It also seems plausible that much of the organic nonaqueous-phase liquid may have been retained in the soil column because of the residual saturation. Numerical modeling of vadose zone flow and transport indicates that 66% to 90% of the carbon tetrachloride discharged to the 216-Z-9 site was retained in the vadose zone (Piepho 1996). It should be noted, however, that DNAPL characteristically moves nonuniformly downward through the vadose zone (Cohen et al. 1993), so this estimate is probably high.

Another potential indicator of the distribution of the organic phase is the distribution of the associated radionuclide co-contaminants. Transuranics (primarily plutonium-239 and americium-241) discharged to the disposal sites may have been carried in association with the organic-complexant liquid phase. The behavior of the transuranics in such a mixture as the DNAPL moves through the soil is unknown. Typically, when plutonium and americium are released as solutes, they are retained in the upper few meters of the soil column (Johnson 1993b). However at the 216-Z-1A Tile Field, these radionuclides were discharged as co-contaminants with the DNAPL-complexant mixture and are found at depths up to 30 m below the bottom of the tile field (Price et al. 1979). This behavior has been previously attributed to the destruction of the sorptive capacity of the soils by the acidic waste stream. However, the abundant amounts of calcium carbonate in the soil column could have easily neutralized the acid. For example, at a pH of 1 (0.1 M), which is more acidic than the discharged aqueous waste stream (pH of 2.5), the total volume of aqueous waste discharged to the 216-Z-1A Tile Field would have contained approximately 500 kmol of acid. Assuming a calcium carbonate content of 1%, the first meter of the soil column beneath this crib contains 588 kmol of calcium carbonate, which is more than enough calcium carbonate to neutralize this amount of acid (Johnson 1993b). Thus, it seems more probable that the greater depth distribution of transuranics in this crib is due to migration with the solvent-complexant phase. Beneath the 216-Z-1A Tile Field, increases in concentrations of plutonium and americium with depth are generally associated with an increase in the silt content of the sediments or with boundaries between sedimentary units. Because similar solvent-chemical conditions existed for disposal at the other carbon tetrachloride sites, similar depth distributions of significant transuranic concentrations could be encountered at these other sites.

Volatilization of carbon tetrachloride from aqueous- and nonaqueous-phase liquids within the disposal cribs and the vadose zone results in vapor-phase carbon tetrachloride in soil pores. Contaminated vapor can migrate by molecular diffusion and by advective flow. Vapors can diffuse along a chemical gradient from high concentration to low in any direction (including upgradient with respect to the groundwater flow direction). The presence of a relatively low-permeability zone, such as a building foundation or soil horizon, can also enhance the lateral extent of diffusion. The presence of locally saturated or near-saturated vadose zone sediments underlying other aqueous waste disposal sites can inhibit the lateral extent of diffusion.

Because of the density of the carbon tetrachloride vapor, the density of the contaminated vapor phase is greater than uncontaminated vapor in the vadose zone (Table H-8). This contrast in densities can result in density-driven advective flow, which would move carbon tetrachloride vapor downward and laterally from the disposal facilities. Density-driven advection occurs primarily in soils with hydraulic conductivities typical of coarse sand and gravel (Pankow and Cherry 1996, Freeze and Cherry 1979). In these types of high-permeability soils, density-driven advection may attain velocities on the order of meters per day, but only if the density contrast is high (Pankow and Cherry 1996). Density-driven advective vapor flow may have contributed to the high vapor-phase carbon tetrachloride concentrations above the Plio-Pleistocene layer prior to remediation.

Within the vadose zone, carbon tetrachloride vapor may also flow in any direction along pressure gradients caused by barometric pressure fluctuations, which are damped and delayed as they propagate through the subsurface. The fluctuations are increasingly damped and delayed in the subsurface as the cumulative relative permeability of the overlying materials decreases. The pressure gradients may be vertical as a result of the pressure contrast between the subsurface and the surface or between soils above and below a lower permeability layer, or the pressure gradients may be horizontal between a location in the subsurface (e.g., open borehole) that communicates instantaneously with surface pressure changes and another location in the subsurface that communicates more slowly through the interconnected pore space in the vadose zone (Rohay 1996). Because most boreholes in the 200 West Area are (or for many years were) capped but unsealed at the surface, each borehole has the potential to draw carbon tetrachloride vapors horizontally from the source area toward its open interval. Because most boreholes have no annular seal or have an annular seal designed to prevent water migration, the potential for vapor communication and transport also exists along the outside of the casing.

As the contaminated vapor moves into uncontaminated areas in the vadose zone, it may partition into the soil moisture and adsorbed phases. The carbon tetrachloride vapor may also provide a continuous source of contamination to groundwater. In the vadose zone, carbon tetrachloride vapors that equilibrate with perched water, with wastewater from other sources, and/or with infiltrating natural recharge water may then be transported to the water table in dissolved form. These aqueous transport mechanisms can also affect the soil moisture and adsorbed phases contaminated by vapor.

Carbon tetrachloride may volatilize from the dissolved groundwater plume. The contaminant vapors would then move upward by diffusion but may become temporarily trapped below the

Plio-Pleistocene layer. The distribution of carbon tetrachloride vapor below the Plio-Pleistocene layer throughout much of the 200 West Area underlain by the groundwater plume suggests that these vapors may have volatilized from the dissolved groundwater plume throughout the 200 West Area.

Vapor transport, although still occurring, is expected to have been significantly reduced by removal of vapor since 1992 using SVE.

Older, poorly sealed wells, which penetrate either the Plio-Pleistocene unit and/or the water table, may provide a vertical conduit for fluids. Nonaqueous-phase liquid carbon tetrachloride, aqueous-phase dissolved carbon tetrachloride, and vapor-phase carbon tetrachloride that intercept the borehole in the subsurface may migrate downward along the outside casing of the well. In addition, these fluids may be channeled along natural preferential pathways, such as fractures, clastic dikes, and large, interconnected pores, within the vadose zone.

Migration of fluids, both liquid and vapor, are influenced by the natural stratification and variability of the sediments. The Plio-Pleistocene paleosurface is a relatively continuous, lower permeability barrier to vertical movement of fluids in the vadose zone. This layer most likely diverted carbon tetrachloride liquid and/or vapor laterally away from primary carbon tetrachloride disposal sites until a sufficient amount accumulated to force the liquid or vapor through the lower permeability layer (Rohay and Johnson 1991). The surface of the Plio-Pleistocene unit generally slopes toward the south from the primary carbon tetrachloride disposal sites (Rohay et al. 1994a). For example, DNAPL may have migrated from 216-Z-1A to the south toward the 216-Z-18 site, where carbon tetrachloride was detected during drilling of monitoring wells 299-W18-9, 299-W18-10, and 299-W18-11 in 1968, before the crib was placed into service. However, as mentioned earlier, recent work by the University of South Carolina (Temples et al. 2001) would suggest that movement of DNAPL may have been to the north of the 216-Z-9 Trench. The character of the Plio-Pleistocene layer varies across the 200 West Area and includes locally less-cemented, more permeable areas and fractures that allow more rapid fluid flow (Slate 1996).

Because of its low dielectric constant, carbon tetrachloride can theoretically increase the permeability of subsurface materials and thereby strongly influence its own migration pathway. Solutions with high dielectric constants, such as water (Table H-8), will cause alumino-silicate clays to swell. A liquid with a low dielectric constant, such as carbon tetrachloride, could cause clays to shrink and thereby increase the permeability of the soil through the introduction of cracks and fissures. Clay-sized particles that include alumino-silicate clay minerals occur throughout the vadose zone but are typically more abundant in the Plio-Pleistocene unit (Wright et al. 1994). Alumino-silicate clay minerals are also a component of the bentonite commonly used in annular seals for boreholes. However, based on the evaluation presented in Pankow and Cherry (1996), it appears unlikely that either aqueous-phase or nonaqueous-phase carbon tetrachloride liquid would have an impact on the permeability of the subsurface soils. Because of its low aqueous solubility, dissolved concentrations of carbon tetrachloride are too low to significantly decrease the dielectric constant of the aqueous phase (Pankow and Cherry 1996). Nonaqueous-phase carbon tetrachloride must first dissolve into the water film surrounding the

subsurface clays, also resulting in only a low-concentration aqueous phase in contact with the clays (Pankow and Cherry 1996).

Carbon tetrachloride may become “irreversibly” adsorbed within intraparticle pore spaces. Pore sizes within a particle of soil range from macropores (pores with diameters greater than 500 Å) to micropores (cylindrical or slit-shaped pores with diameters less than 20 Å) (Yonge et al. 1996). As summarized by Yonge et al. (1996), Farrell and Reinhard (1994) have demonstrated that adsorption of contaminant in micropores can be significant and state that complete desorption may require months to years. Because the approximate molecular diameter of carbon tetrachloride is 5 Å, it would have access to micropores (Yonge et al. 1996). The adsorption of carbon tetrachloride would be higher in the silty sands, which have a significantly higher amount of surface area than the sands (Ford 1996). The adsorption of carbon tetrachloride would also increase with time (Wilson et al. 1994).

Based on laboratory studies using carbon tetrachloride and site-specific soils, Yonge et al. (1996) estimated that SVE can remove only 10% to 15% of the initial mass of carbon tetrachloride (excluding any nonaqueous liquid phases) in contaminated zones through which flow is passing directly. Based on laboratory tests in which mass removal was dependent on carbon tetrachloride diffusion to the zone through which flow was passing, they describe four phases in the concentration-time profile: initial pore gas evacuation, free product removal, vapor diffusion from low-velocity fields (transitional phase) and, finally, desorption-controlled removal (tailing phase). In field situations, which involve a heterogeneous subsurface, Yonge et al. (1996) expect to observe an initial phase during which concentrations decrease relatively rapidly and at least one subsequent phase during which concentrations decrease more slowly. Based on the carbon tetrachloride SVE and rebound data available in 1997, Cameron (1997) estimated that most of the vapor extraction site had passed through the initial pore gas evacuation and free product removal phases and that part of the site was in the transitional phase and part was in the tailing phase.

H1.4.3 Vadose Zone/Groundwater Interface

The capillary fringe forms the interface between the vadose and groundwater zones. Carbon tetrachloride in an aqueous or DNAPL phase can migrate through the capillary fringe. The primary mechanisms for aqueous phase migration through the capillary fringe are diffusion and dispersion, advection due to infiltrating water, and water-table fluctuations (Pankow and Cherry 1996).

Carbon tetrachloride vapor that reaches the capillary fringe can partition into the aqueous phase. A vapor-phase source should result in a shallow (1- to 2-m thick) vertical distribution in the aquifer due to the relatively slow process of molecular diffusion, the process by which the carbon tetrachloride vapor enters the groundwater (Pinder and Abriola 1986). Pankow and Cherry (1996) point out that infiltrating water is probably a more effective transport mechanism than diffusion and dispersion. At the carbon tetrachloride disposal sites, an infiltrating water mechanism would have been more viable during operations when large volumes of water were artificially recharging the groundwater.

The elevation of the water table at the carbon tetrachloride site changes in response to barometric pressure fluctuations, local and regional artificial recharge, and pump-and-treat operations. Each of these may influence carbon tetrachloride migration. The elevation of the water table below the carbon tetrachloride source cribs fluctuates up to 0.2 m daily in response to barometric pressure fluctuations. Over a 20-year period (1965-1985) of liquid discharges to the U Pond, the elevation of the water table below the carbon tetrachloride site rose and then declined 2 m; it is currently declining 0.40 m/yr (DOE-RL 2002). The 2-m rise from 1965 to 1977 may have resulted in carbon tetrachloride at the capillary fringe dissolving into the groundwater. The gradual but continual water table decline since 1977 would minimize additional contamination of the groundwater, but the daily fluctuations create a mixing zone that may continue to incorporate carbon tetrachloride. Temporary cessation of pump-and-treat operations at individual extraction wells would cause the water table to rise locally, incorporating carbon tetrachloride that migrated downward into the cone of depression. However, cessation of operations occurs infrequently, and this mechanism may be insignificant with respect to degradation of groundwater quality. This mechanism seems an unlikely explanation of the increased concentrations observed at extraction well 299-W15-32 following temporary shutdown in 1999, as described previously. In that case, the increase in concentrations at the well appeared to be delayed, whereas the drawdown of newly contaminated water would probably be "instantaneous."

Transport and partitioning of carbon tetrachloride vapor between the vadose zone and groundwater may contribute to the large "low-concentration halo" surrounding the high-concentration core of the groundwater plume.

Lateral spreading of DNAPL may occur at the capillary fringe until sufficient hydraulic head builds up to displace water and allow the organic liquid to move into the groundwater (Pankow and Cherry, 1996). Residual DNAPL would remain at this interface even after the main body of DNAPL contamination moved through. DNAPL that reached the 216-Z-9 capillary fringe prior to 1965 was probably incorporated into the groundwater by the rise of the water table between 1965 and 1977.

Potentially, a continuing source of carbon tetrachloride to the groundwater in the area below the 216-Z-9 site existed in the past when the zone of highest concentration still included the area underlying the disposal site. Numerical modeling of vadose zone flow and transport indicates that both dissolved and nonaqueous-phase carbon tetrachloride reached the groundwater beneath the 216-Z-9 Crib and may have continued to enter the aquifer for many years. The low vapor concentrations observed deep within the vadose zone at the 216-Z-9 Trench since 1997 suggest that SVE may have removed much of the deep vadose zone carbon tetrachloride source in this area and that any continuing groundwater source may now be within the aquifer (Rohay 1997).

Carbon tetrachloride concentrations monitored in the deep soil vapor and in underlying groundwater in the 216-Z-9 area since 1997 do not appear to be in equilibrium, and the expected direction of carbon tetrachloride migration is from the groundwater to the vadose zone (Rohay 1997).

H1.4.4 Groundwater

Numerical modeling of carbon tetrachloride flow and transport in the vadose zone indicates that the depth of penetration of carbon tetrachloride (dissolved and nonaqueous phases) into the aquifer depends on the residual saturation in the vadose zone, which affects the flux to the aquifer, and the groundwater flow rate, which affects the lateral to vertical flux within the aquifer (Piepho 1996). For the higher value of residual saturation (0.01) used in the modeling, dissolved carbon tetrachloride reached approximately 20 m below the water table and nonaqueous-phase carbon tetrachloride reached approximately 10 m below the water table. For the lower value of residual saturation (0.0001) used in the modeling, dissolved carbon tetrachloride reached approximately 50 m below the water table and nonaqueous-phase carbon tetrachloride reached approximately 25 m below the water table. (Note: The nonaqueous-phase case for a residual saturation of 0.0001 was not shown in Piepho [1996]; the 25-m depth was estimated by analogy to higher residual saturation case.)

Preliminary sitewide numerical modeling of carbon tetrachloride transport in the aquifer indicates that under nonretarded flow conditions, contaminant concentrations in excess of 5 $\mu\text{g/L}$ will move significantly past the 200 East Area perimeter in 200 years (Chiaramonte et al. 1997). However, if a small retardation factor is included in the analysis, the movement of carbon tetrachloride will be significantly slowed. The extent of contamination is very sensitive to the carbon tetrachloride partitioning coefficient between the aquifer sediments and groundwater. Values for the partitioning coefficient are not well defined for Hanford sediments. Other important factors that this modeling effort did not take into account were biodegradation, abiotic degradation, and volatilization of carbon tetrachloride during transport. These factors may reduce the extent of contamination over any comparable period of time. Another modeling effort, using an accepted sitewide groundwater model, should be performed to account for these other factors, and predict the future extent, geometry, and concentrations of carbon tetrachloride. Such a modeling effort will be necessary to support a final remedy selection and risk analysis.

Partitioning of carbon tetrachloride to aquifer sediments is assumed to be low (or zero) and may be variable across the site. Site-specific measurements of the partitioning coefficient magnitude and spatial distribution have not been published. However, a distribution coefficient (K_d) of 0.0 to 0.2 mL/g was suggested as likely for carbon tetrachloride aqueous solutions on Hanford Site soil based on batch K_d experiments (Last and Rohay 1993). A literature estimate for soil distribution of carbon tetrachloride is 0.114 mL/g (Chiaramonte et al. 1997). To calculate the inventory of carbon tetrachloride sorbed to vadose zone soils in 1990, a K_d value of 0.192 mL/g was estimated using the method of Thibodeaux et al. (1990) (WHO 1993). This K_d value falls within the range discussed for partitioning of carbon tetrachloride to aquifer sediments.

More recently, as part of an innovative treatment remedial demonstration for carbon tetrachloride, Truex et al. (2001) conducted a review of current published literature on potential natural attenuation processes that could affect the concentration of carbon tetrachloride. In the literature review, Truex et al. examined the K_d and abiotic half-lives for carbon tetrachloride. The range of K_d values was determined to be 0.016 to 0.83 L/kg; the most probable value of K_d

for the Hanford Site aquifer was estimated at 0.12 L/kg. For abiotic transformation of carbon tetrachloride, the range of reported half-lives was found to be 36 to 290 years; the best estimate for the half-life was approximately 100 years. Because these factors could have a significant effect on migration and concentrations of carbon tetrachloride, additional laboratory or in situ tests on Hanford Site sediments are recommended. Test results will support future predictive modeling and analytical evaluation of carbon tetrachloride concentrations. The estimated K_d value of 0.12 L/kg is similar to the 0.114 L/kg used in the previous modeling study by Chiaramonte et al. (1997).

The carbon tetrachloride plume for FY 2001 (Figure H-6) has a similar shape as the FY 2000 plume, but the overall concentration distribution has changed. High concentrations of carbon tetrachloride present beneath the Plutonium Finishing Plant complex are being drawn toward the extraction wells. In the area of the injection wells, concentrations continue to decline from the injection of treated groundwater into the aquifer, and as hydraulic mounding drives groundwater toward the extraction wells. The high-concentration area of the plume appears to be shrinking in size, evidenced by decreasing concentrations in monitoring and extraction wells, the smaller area of the 4,000 $\mu\text{g/L}$ contour intervals, and decreasing concentrations in the 200-ZP-1 influent tank from 4,041 $\mu\text{g/L}$ in FY 2000 to 3,600 $\mu\text{g/L}$ in FY 2001. In addition, the groundwater data no longer support a 6,000 $\mu\text{g/L}$ contour (DOE-RL 2002).

H1.5 ORGANIC CO-CONTAMINANTS

The ratio of chloroform (a carbon tetrachloride biodegradation breakdown product) to carbon tetrachloride concentrations in vapor extracted using the SVE system is linear (Figure 5-35). For carbon tetrachloride concentrations greater than 1,000 ppmv, chloroform concentrations are approximately 0.005 that of carbon tetrachloride concentrations.

The 1989 Essential Material Specification for carbon tetrachloride states that the carbon tetrachloride must be 99% pure. Based on the process used to manufacture carbon tetrachloride, it is believed that the carbon tetrachloride used earlier in Z Plant operations was also relatively pure. The other 1% would typically be long-chain alcohols used by industry as additives to prevent light degradation of the product.

The transport and inventory partitioning estimates presented in this discussion have been made using pure liquid-phase carbon tetrachloride properties. However, the carbon tetrachloride was not discharged as a pure liquid but as a mixture with other organics (TBP, DBBP, and lard oil). The liquid properties (density, viscosity, interfacial tension, and vapor pressure) of three representative mixtures, 85:15 carbon tetrachloride:TBP, 50:50 carbon tetrachloride:DBBP, and 50:50 carbon tetrachloride:lard oil, are presented in Table H-8. The organic composites (even the carbon tetrachloride:lard oil mixture) were found to be denser and more viscous than water (Last and Rohay 1993). Vapor pressure of the carbon tetrachloride:DBBP and carbon tetrachloride:lard oil mixtures is only half that of the pure carbon tetrachloride and the carbon tetrachloride:TBP mixture. The interfacial tension between the 50:50 carbon tetrachloride:lard oil mixture and a 5 M sodium nitrate solution was found to be low, suggesting that the fluids

may be somewhat miscible, allowing them to mix and behave more as an aqueous fluid (Last and Rohay 1993).

An 85:15 carbon tetrachloride:TBP ratio was used to make up the organic solution used in the plutonium recovery process. However, with exposure to ionizing radiation and nitric acid, the TBP within the solvent would gradually degrade to DBP. DBP has a much greater affinity for plutonium than TBP and would not work in the process because of its poor stripping properties. It was the degraded solvent that was discharged to the soil column.

The major organic co-contaminants TBP, DBP, and DBBP associated with the carbon tetrachloride solvent waste streams were not analyzed in groundwater samples collected during the 1991 characterization activities. However, existing data for TBP and DBP acquired for other programs between 1987 and 1990 are available. Results for samples from several wells in the vicinity of the Z cribs, as well as from wells within the core of the 200 West Area carbon tetrachloride plume, were all below detection limits for TBP and DBP. DBBP has not been previously analyzed. The apparent absence of TBP and DBP in 200 West Area groundwater is attributed to biodegradation of these organic constituents and/or because they have a moderate affinity for sediments (Ames and Serne 1991, Rohay and Johnson 1991). Soil and groundwater samples collected during drilling in 1992 were analyzed for TBP. TBP was detected in only one sample from the vadose zone (well 299-W15-217, 24.6-m depth), and the result was below the limit of quantitation (Rohay et al. 1994a). Analyses for DBP and DBBP were not conducted. The lack of TBP in vadose soils suggests that TBP degrades relatively quickly. The lack of TBP detected in groundwater suggests that carbon tetrachloride might have been a relatively pure phase when it reached groundwater. However, the differential partitioning and biodegradation of the components of these organic mixtures in Hanford Site sediments has not been determined.

Vadose zone sampling of soil and soil vapor in the source area has also detected methylene chloride, chloroform, TCE, tetrachloroethylene (PCE), trans-1,2-dichloroethene, 1,1-dichloroethane, 1,2-dichloroethane, cis-1,2-dichloroethene, 1,1,1-trichloroethane, benzenes, xylenes, and toluene (Rohay et al. 1994a).

Groundwater sampling within and beyond the source area has also detected chloroform, methylene chloride, TCE, and PCE (Rohay et al. 1994a, DOE-RL 1999b).

PCE and tetrabromoethane were used at different times in combination with carbon tetrachloride as a diluent for TBP or for cleaning agents (Smith 1973, with respect to the wastes discharged to 216-Z-9).

Nitrate in the aqueous wastes discharged to the carbon tetrachloride source cribs has also produced an extensive groundwater plume (Figure H-7). Because nitrate and carbon tetrachloride were co-contaminants in the aqueous-phase discharges, comparison of the distribution of the two groundwater plumes may help in understanding the major factors affecting plume movement. For example, although the K_d for carbon tetrachloride is not well known, the K_d for nitrate is known to be zero (i.e., nitrate is not retarded in groundwater). The maximum extent of the carbon tetrachloride (defined by the 5- $\mu\text{g/L}$ contour) and nitrate

(defined by the 20-mg/L contour) plumes is similar to the north and northeast of the Z Plant area, suggesting that carbon tetrachloride has behaved as a nonretarded contaminant in groundwater (Figures H-4 and H-7). The absence of nitrate and presence of carbon tetrachloride to the southwest of the former U Pond site suggests that the carbon tetrachloride lobe is not a result of southerly flow during the initial period of discharge.

H1.6 DATA GAPS

The nature and extent of the carbon tetrachloride plume have been partially defined, but several key data gaps currently exist. The data gaps are identified in this report to help describe some uncertainties in the existing database being used to formulate the conceptual model.

1. The nature and magnitude of the exchange of carbon tetrachloride between the vadose zone and groundwater needs to be investigated. This information will be required in the future to address the interdependency of the vadose zone-groundwater system in achieving remediation of the 200 West Area subsurface carbon tetrachloride contamination. The study, including field measurements near the groundwater-vadose zone interface, should be undertaken to quantify the volatilization process.
2. The lateral extent of the carbon tetrachloride plume in the vadose zone and vertical extent of the carbon tetrachloride plume in the groundwater need to be better defined. These data would help define the extent of the contamination and therefore the expected magnitude of the remediation efforts.
3. The location, amount, and properties of DNAPL carbon tetrachloride within the subsurface need to be quantified. This information would help focus and define the remediation needs.
4. The residual saturation of carbon tetrachloride needs to be quantified (i.e., the carbon tetrachloride held in vadose zone sediments that is no longer mobile except through partitioning to pore water that is still migrating). This information would help account for inventory between the vadose and groundwater zones, help refine the estimates of flux from the vadose zone to the groundwater, and help refine the numerical modeling estimates of the depth of carbon tetrachloride in the aquifer. Because SVE operations have modified the distribution of subsurface carbon tetrachloride and possibly soil moisture beneath the disposal sites, part of this task would be identification of suitable locations for data collection and measurements.
5. Data are needed to determine the extent of the nonequilibrium sorption in the vadose zone and groundwater. This information would help account for the inventory, support modeling work, and help define remediation needs.
6. The partitioning coefficient (K_d) for carbon tetrachloride on site sediments and its variation across the site needs to be quantified. For example, the literature search by Truex et al.

(2001) revealed that the K_d can vary significantly. This information would help refine the predictions of carbon tetrachloride transport rates using numerical models.

7. The interaction between carbon tetrachloride and calcium carbonate needs to be quantified. This information would help determine carbon tetrachloride transport mechanisms and rates through the Plio-Pleistocene unit.
8. The abiotic half-life of carbon tetrachloride under site conditions needs to be quantified. The potential degradation of carbon tetrachloride may contribute to natural attenuation of the plume and could be a significant term in the assessment of the carbon tetrachloride mass balance.
9. The inventory mass balance should be reevaluated based on more recent studies and data from current remedial actions in the groundwater and the vadose zone. The existing evaluation of the mass balance was based on 1990 groundwater plume data for the upper 10 m of the aquifer and limited soil vapor data. This information would help define the source term.
10. The hydraulic flow fields during and after the carbon tetrachloride disposal should be reevaluated to determine if the distribution of the relatively high concentrations of carbon tetrachloride to the northwest, the low-concentration lobes of carbon tetrachloride to the south, and the concentrations of carbon tetrachloride near T Plant are reasonable based on the hydraulics alone. Results of this evaluation potentially may identify other contributing carbon tetrachloride disposal areas.
11. A systematic study of the carbon tetrachloride/chloroform relationship in both the vadose zone and groundwater should be conducted using existing data. Understanding the cause and significance of the variation in the ratio of carbon tetrachloride to chloroform could potentially yield insights on contaminant source, inventory, distribution, and persistence of the chloroform plume. This study could be extended to include the full carbon tetrachloride degradation chain to support evaluation of natural attenuation.
12. A predictive modeling effort needs to be performed that considers the fate and transport of carbon tetrachloride over the next several hundred years. Such a model is needed to account for all of the significant factors that affect the migration and concentration of carbon tetrachloride and ultimately will be needed to support final remediation decisions.
13. Numerical modeling of carbon tetrachloride migration in the vadose zone is needed that incorporates the effects of three-dimensional stratigraphy and heterogeneities, multi-phase flow, and co-contaminants. This model could help guide characterization and remediation efforts in vadose zone and groundwater and support selection of remedial alternatives.

H1.7 REFERENCES

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Figure H-1. Schematic Illustration of Carbon Tetrachloride and Wastewater Migration Beneath the 216-Z-9 Trench in the Higher Concentration Portion of the Plume.

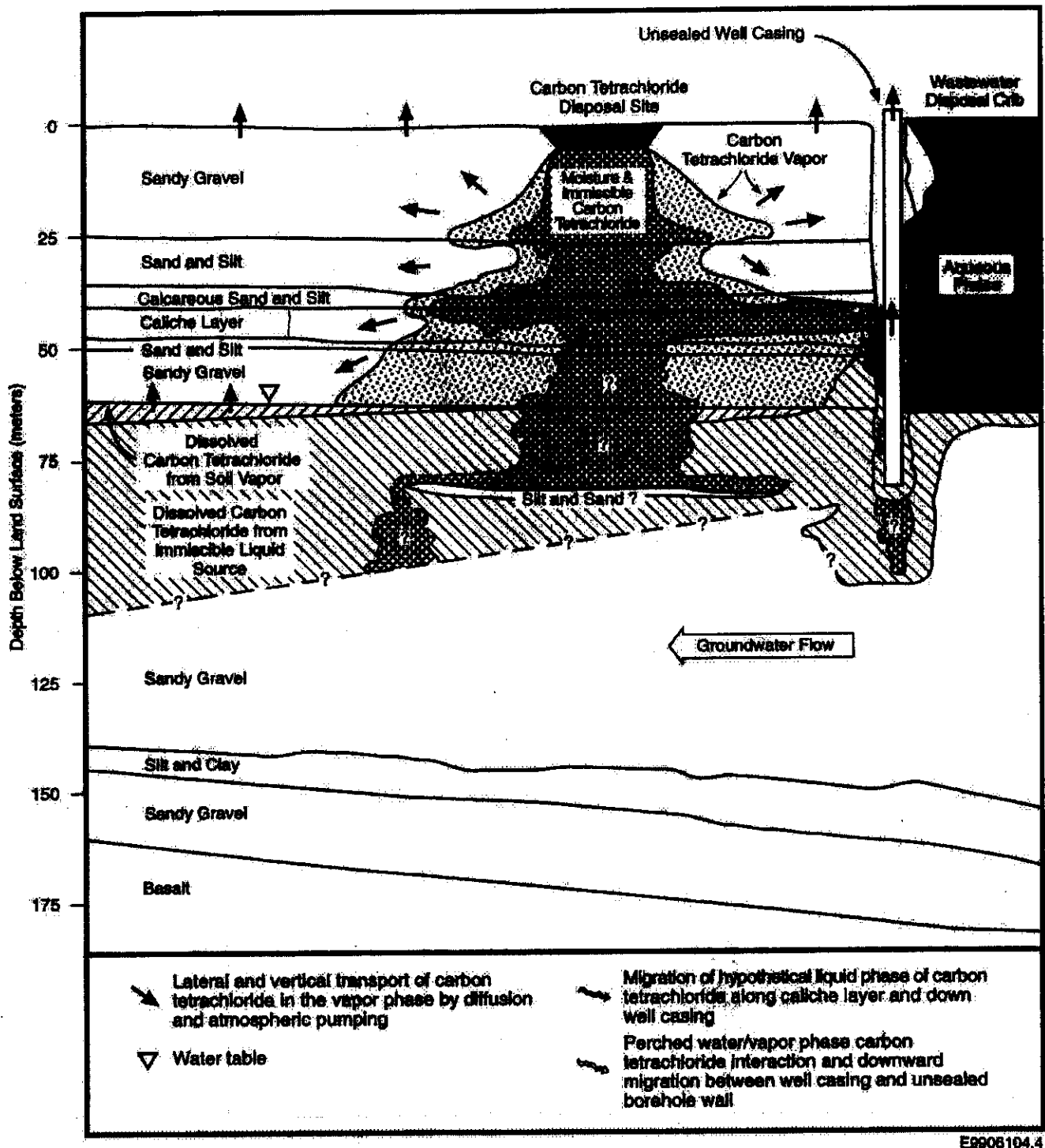


Figure H-2. Hydrographs for Four TX-TY Tank Farm Wells.

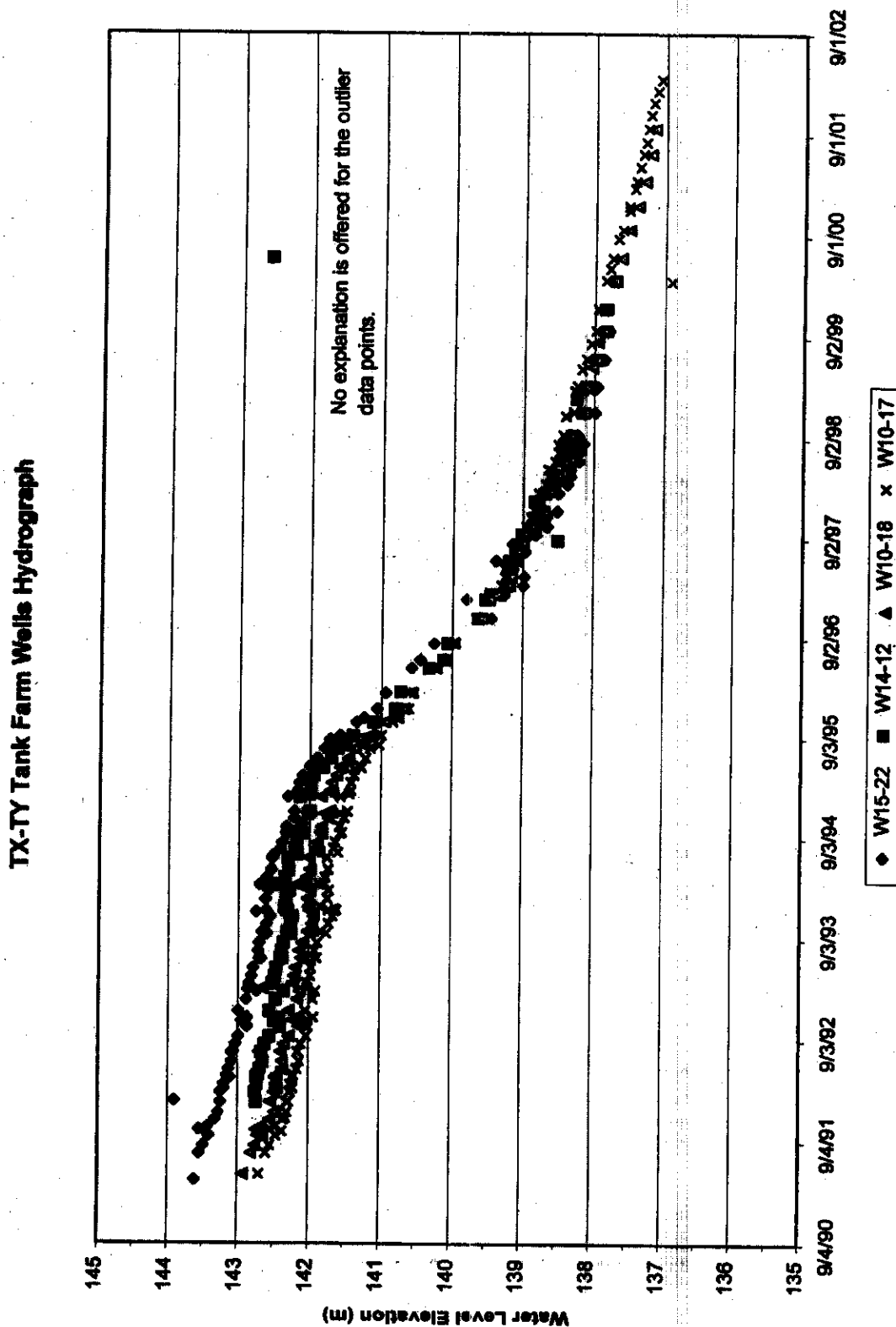


Figure H-3. Difference in Water Level Elevation Between
Wells 299-W15-16 and 299-W15-17.

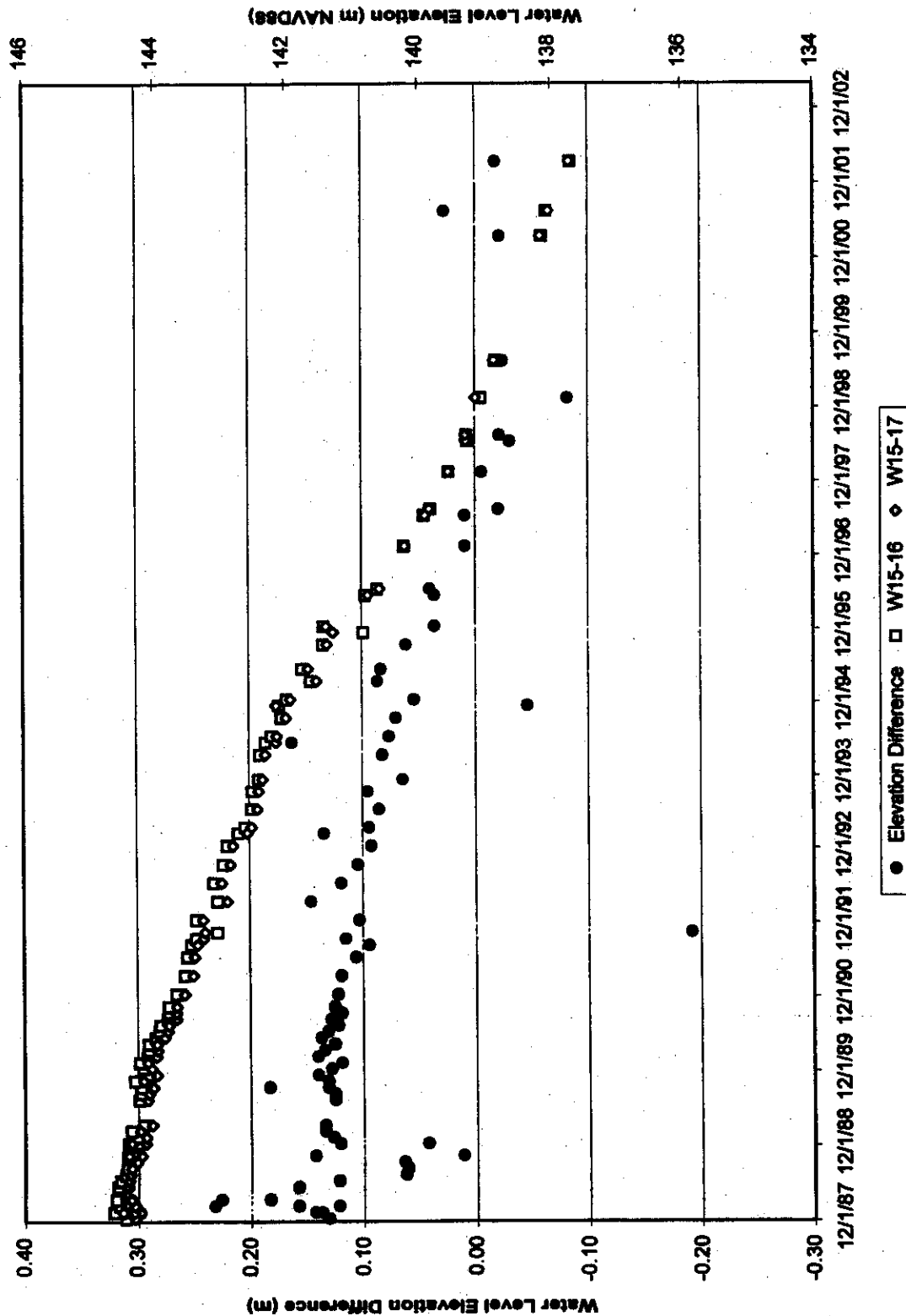


Figure H-4. Average Carbon Tetrachloride Concentrations in the 200 West Area, Top of Unconfined Aquifer (from Hartman et al. 2002).

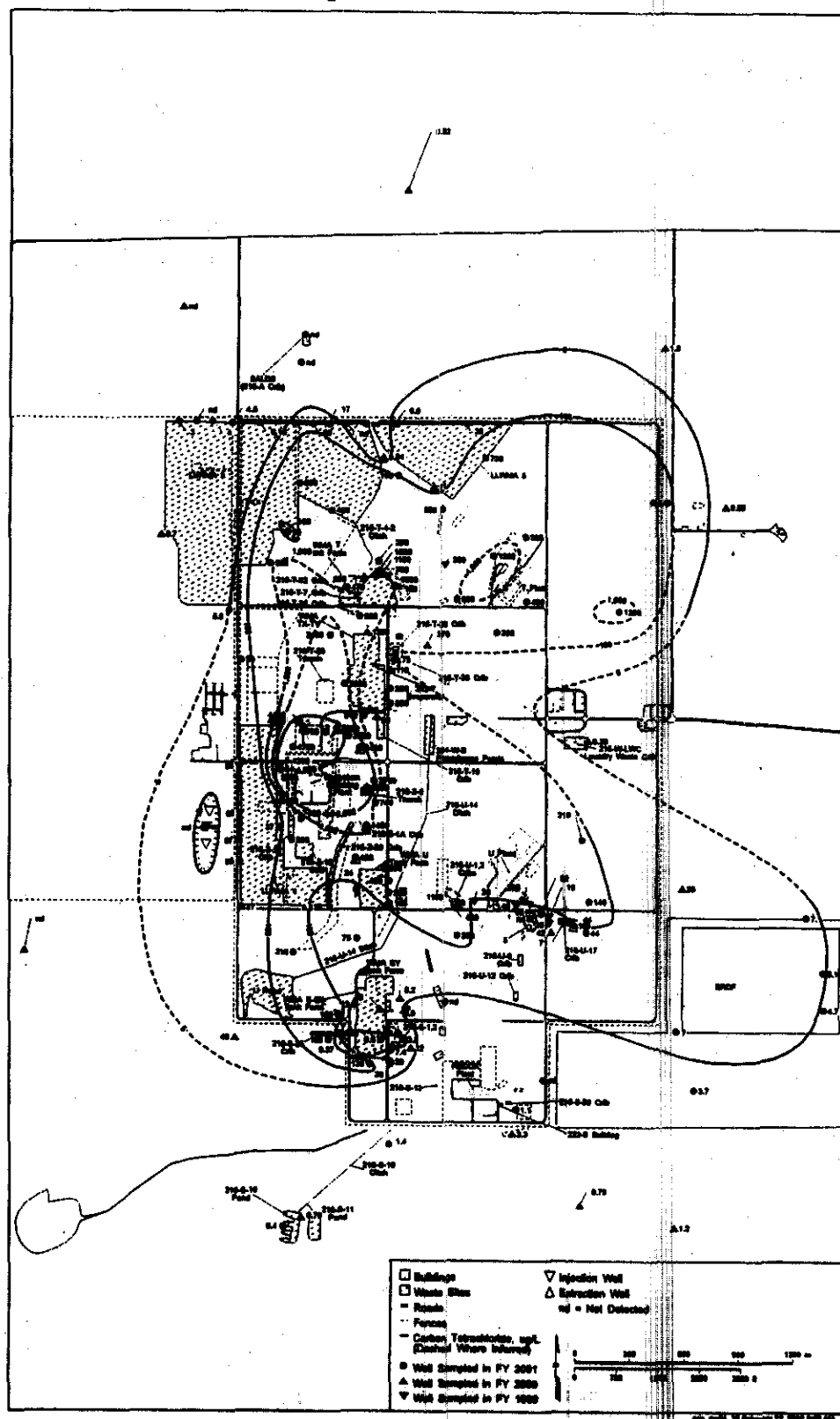
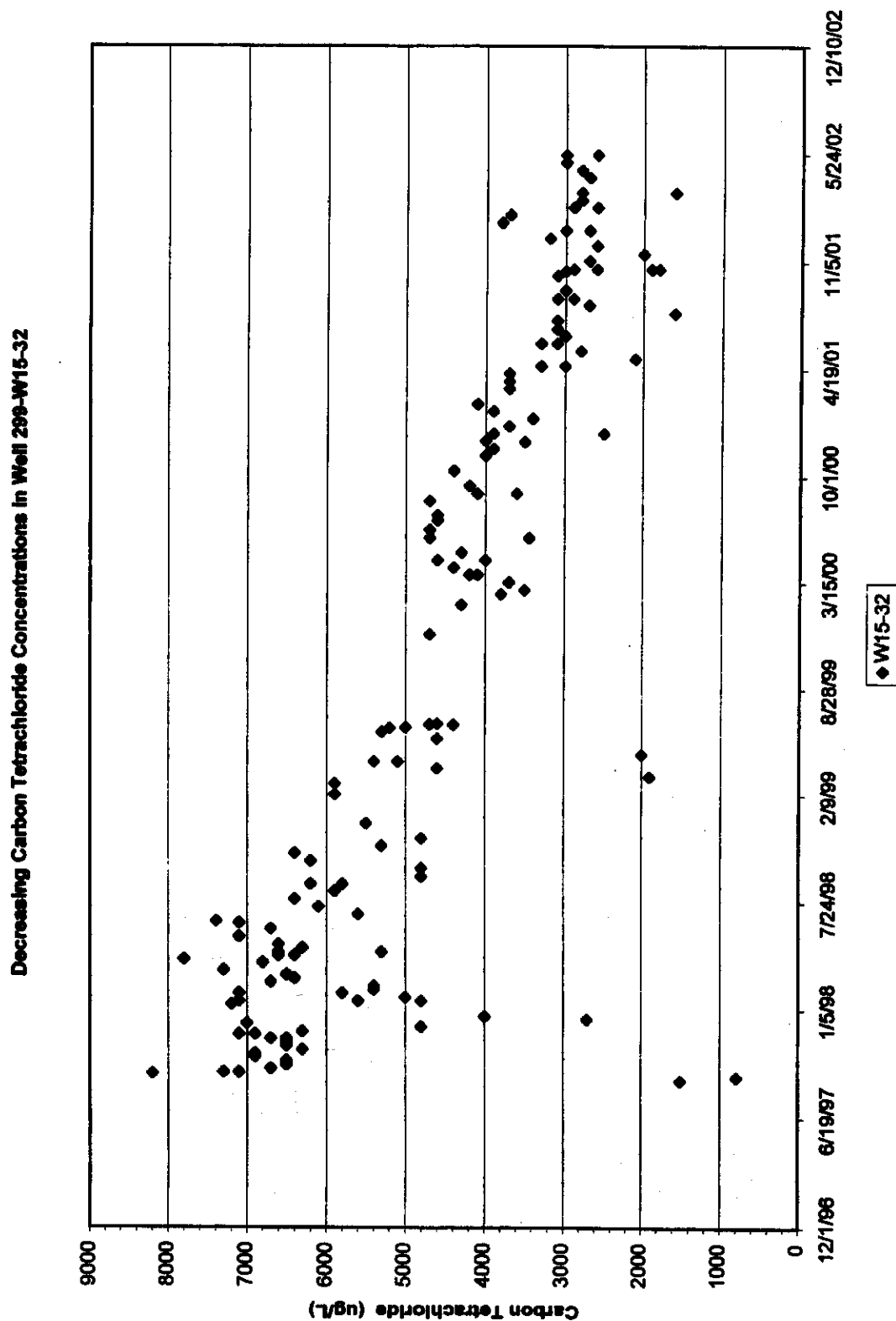
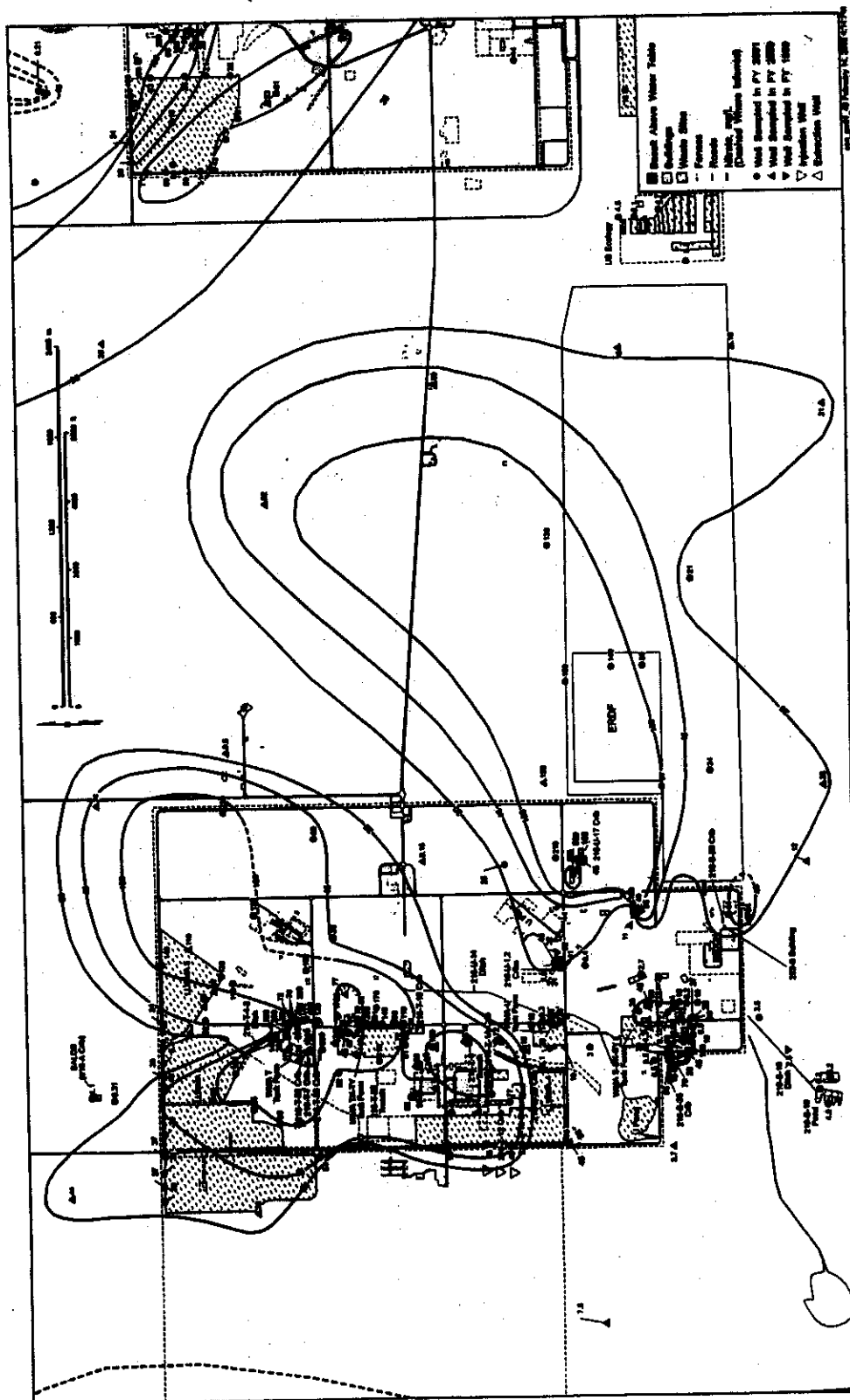


Figure H-5. Decreasing Carbon Tetrachloride Concentrations at
Extraction Well 299-W15-32, Located Next to the 216-Z-9 Trench.



[illegible]

Figure H-7. Average Nitrate Concentrations in the 200 West Area
(from Hartman et al. 2002).



Appendix H – 2001 Carbon Tetrachloride Conceptual Model Update

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Table H-1. Waste Constituent Inventory Summary for the Three Primary Carbon Tetrachloride Disposal Facilities (from Rohay et al. 1994a).

Facility	Operating Dates	Total Volume (L)	Plutonium (kg)	Americium (kg)	Carbon Tetrachloride (kg)	Carbon Tetrachloride (L)	TBP (L)	DBBP (L)	Lard Oil (L)
216-Z-9	1955 to 1962 ^a	4.09E+06	106 ^c	2.5	130,000 – 480,000	83,000 – 300,000	27,900	46,500	9,300
216-Z-1A	1949 to 1959 ^b	1.00E+06	0.05	ND	ND	ND	ND	ND	ND
	1964 to 1969	5.20E+06	57	1	270,000	170,000	23,900	27,500	11,000
216-Z-18	1969 to 1973	3.86E+06	23	0.4 ^d	170,000	110,000	16,400	19,100	ND
Total	1955 to 1973	1.42E+07	186 ^c	3.9	570,000 – 920,000	363,000 – 580,000	68,200	93,100	20,300

^aThe Recuplex operation that used carbon tetrachloride was discontinued after a criticality incident in April 1962 and was replaced in 1964 by the Plutonium Reclamation Facility (DOE-RL 1991).

^bFrom 1949 to 1959, the 216-Z-1A Tile Field received slightly basic, aqueous waste via overflow from associated 216-Z-1, -2, and -3 cribs prior to disposal of carbon tetrachloride waste (Price et al. 1979). From 1964 to 1969, carbon tetrachloride wastes were discharged directly to 216-Z-1A.

^c58 kg were later removed (Ludowise 1978).

^dBased on ratio of 1 kg americium to 57 kg plutonium for 216-Z-1A.

DBBP = dibutyl butyl phosphonate

ND = no available data

TBP = tributyl phosphate

Table H-2. General Characteristics of the Vadose Zone Underlying the Carbon Tetrachloride Disposal Sites.

Geologic Unit	Geologic Material	Depth (m below ground surface)	Thickness (m)	Intrinsic Permeability (m ²) ^a	Field Moisture Content ^b (vol %)	Air Conductivity ^a (m/day)	Equivalent Hydraulic Conductivity ^a (m/day)
Hanford upper fine (H _{uf})	Gravelly sand and sand	0 – 6	6	1.6 E-11	5.5	1	9.0
Hanford upper coarse (H _{uc})	Gravel	6 – 16	10	4.1 E-10	4.6 – 5.7	25	231.4
Hanford fine (H _f)	Sand	16 – 31	15	1.6 E-11	1.5 – 19.7	1	9.0
Hanford lower coarse (H _{lc}) ^c	Sandy gravel	31 – 34	3	3.3 E-10	5.1 – 5.3	20	186.3
Hanford lower fine (H _{lf}) ^c	Interbedded silt and fine sand	34 – 38	4	1.6 E-12	6.1 – 11.8	0.1	0.9
Plio-Pleistocene (P-P)	Fine sandy silt/ carbonate- cemented sandy gravel ("caliche")	38 – 45	7	8.2 E-13	8.1 – 38.5	0.05	0.5
Ringold Unit E (R _{pe})	Gravel	45 – 66	21	1.3 E-10	3.4 – 17.6	8	73.4

^aCalibrated values based on numerical airflow model (Rohay and McMahon 1996).

^bBased on samples collected during drilling at the carbon tetrachloride sites in 1992 and 1993 (Wright et al. 1994).

^cNot present underlying the 216-Z-9 Trench.

Table H-3. Configuration of the Plio-Pleistocene Unit Underlying the Carbon Tetrachloride Disposal Sites.

Plio-Pleistocene Unit	216-Z-9 Site	216-Z-1A/Z-18/ Z-12 Site	Both Sites
Minimum depth to top ^a (m bgs)	31	36	--
Maximum depth to top ^a (m bgs)	35	45	--
Average depth to top ^a (m bgs)	34	39	38
Minimum depth to bottom ^a (m bgs)	35	42	--
Maximum depth to bottom ^a (m bgs)	45	54	--
Average depth to bottom ^a (m bgs)	38	48	45
Minimum thickness ^b (m)	2	4	--
Maximum thickness ^b (m)	6	11	--
Average thickness ^b (m)	4	7	6

^aBased on 11 wells at 216-Z-9 and 42 wells at 216-Z-1A/Z-18/Z-12.

^bBased on 8 wells at 216-Z-9 and 18 wells at 216-Z-1A/Z-18/Z-12.

Table H-4. Disposition of Carbon Tetrachloride Inventory Discharged to the Soil Column.

Carbon Tetrachloride Disposition	Percent of Estimated Original Carbon Tetrachloride Inventory (Average 750,000 kg)	Estimated Mass of Carbon Tetrachloride (kg)	Reference
Estimated using pre-remediation data			
Equilibrium partitioning within vadose zone into vapor, dissolved, and adsorbed phases	12	91,000	WHC 1993
Lost to atmosphere	21	159,000	WHC 1993
Biodegraded	1	8,000 (4,385 for Z-9 only)	Hooker et al. 1996
Dissolved in upper 10 m of unconfined aquifer (assuming 30% porosity and no partitioning to aquifer solids)	1-2	5,250 – 15,740	Rohay and Johnson 1991
DNAPL/residual in vadose and/or unconfined aquifer	65	484,000	WHC 1993
Measured using remediation data			
Removed from vadose zone using soil vapor extraction (FY 1991-FY 2001)	10	77,150	Table 4-1
Removed from unconfined aquifer using pump and treat (200-ZP-1 and 200-UP-1 operations) (FY 1994-FY 2001)	0.6	5,820	DOE-RL 2002

Table H-5a. Mass Estimate of Carbon Tetrachloride Contained in Groundwater Plume in 1990 (from Rohay and Johnson 1991).

Contour Interval (µg/L)	Area (m ²)	Median Concentration (µg/L)	Calculated Mass (kg) ^a		Percent of Total	Cumulative Percent
			Porosity = 10%	Porosity = 30%		
10-100	8.34 E+06	55	460	1,380	8.75	8.75
100-1,000	3.09 E+06	550	1,700	5,100	32.39	41.14
1,000-2,000	0.64 E+06	1,500	970	2,900	18.44	59.58
2,000-3,000	0.30 E+06	2,500	760	2,280	14.49	74.07
>3,000	0.27 E+06	5,000	1,360	4,080	25.93	100.00
Total	12.65 E+06		5,250	15,740	100.00	

^aAssuming a depth of 10 m.

Table H-5b. Mass Estimate of Carbon Tetrachloride Contained in Groundwater Plume in 1996 (from Koegler 1997).

Contour Interval ($\mu\text{g/L}$)	Volume (m^3) ^a	Average Aqueous Concentration ($\mu\text{g/L}$)	Aquifer Mass			Sorbed Mass for $K_d = 0.05$ L/mg (kg) ^b	Sorbed Mass for $K_d = 0.114$ L/mg (kg) ^b
			kg ^b	Percent of Total	Cumulative Percent		
5 - 100	19,462,500	38.45	748	6.13	6.13	227	518
100 - 250	8,647,500	157.74	1,364	11.18	17.31	414	943
250 - 500	5,092,500	357.40	1,820	14.91	32.22	552	1,259
500 - 750	2,700,000	615.44	1,662	13.62	45.84	504	1,149
750 - 1,000	1,860,000	868.65	1,616	13.24	59.08	490	1,117
1,000 - 1,250	1,275,000	1092.70	1,393	11.42	70.50	423	964
1,250 - 2,000	832,500	1554.88	1,294	10.60	81.10	3,93	895
2,000 - 3,000	330,000	2452.79	809	6.63	87.73	246	560
3,000 - 4,000	232,500	3527.29	820	6.72	94.45	249	567
> 4,000	157,500	4299.37	677	5.55	100.00	205	468
Total	40,590,000	--	12203	100.00	--	3406	8440

^aAssuming a depth of 10 m.

^bAssuming a porosity of 30%.

Table H-6. Pore Column Volume Estimates for the Carbon Tetrachloride Cribs.

Waste Disposal Facility	North-South Length (m)	East-West Length (m)	Bottom Area (m^2)	Depth to Water (m)	Average Annual Discharge (L)	Infiltration Rate ($\text{L}/\text{m}^2/\text{day}$)	Porosity (%)	Column Pore Volume (L)	Total Discharge Volume (L)	% Pore Volume
216-Z-1A	84	35	2,940	57	1.15E+06	1.07	30	5.03E+07	6.21E+06	12
216-Z-9	18.3	9.1	167	57.6	6.08E+05	10.00	30	2.88E+06	4.09E+06	142
216-Z-18	63	12	756	59	9.74E+05	3.53	30	1.34E+07	3.86E+06	29

Table H-7. Estimated Depth of Organic Migration Beneath the Carbon Tetrachloride Cribs (from Rohay et al. 1994a).

Waste Disposal Facility	North-South Length (m)	East-West Length (m)	Bottom Area (m^2)	Depth to Water (m)	Total Organic Discharge (L)	Residual Saturation (%)	Depth of Migration (m)
216-Z-1A	84	35	2,940	57	1.75E+05	2.5	2
216-Z-9	18.3	9.1	167	57.6	8.30E+05 to 3.00E+05	2.5	20 to 72
216-Z-18	63	12	756	59	1.10E+05	2.5	6

Table H-8. Physical Properties of Carbon Tetrachloride (from Last and Rohay 1993).

Property	Units	Pure Carbon Tetrachloride	85% Carbon Tetrachloride, 15% TBP by volume	50% Carbon Tetrachloride, 50% DBBP by volume	50% Carbon Tetrachloride, 50% Lard Oil by Volume	Water
Liquid density	g/mL at 20°C	1.59 ^{bc}				1.00 ^{bc}
	g/mL at 25°C		1.51 ^d	1.27 ^d	1.25 ^d	
Absolute viscosity	centipoise at 24°C		5.75 ^d	4.50 ^d	10.50 ^d	
	centipoise at 20°C	0.97 ^{bc}				1.00 ^b
Interfacial tension with air	dynes/cm at 24°C		31.0 ^d	32.0 ^d	33.0 ^d	
Interfacial tension with water	dynes/cm at 24°C		23 ^d	11 ^d	18 ^d	
	dynes/cm at 20°C	45.0 ^b				
Interfacial tension with 5 M sodium nitrate	dynes/cm at 24°C		11 ^d	19 ^d	7 ^d	
Vapor pressure	cm H ₂ O at 24°C, 30.1 in. Hg	130 ^d	100 ^d	52 ^d	60 ^d	
	25°C	109 ^c				
	20°C	90 ^b				
Saturated vapor concentration	mg/L at 20°C	754 ^a				
	ppmv at 20°C	120,000 ^a				
Saturated vapor density	g/L at 25°C, 1 atm	6.29 ^b				Dry air = 1.204 ^b
Relative vapor density (dry air)	Saturated at 25°C and 1 atm	1.62 ^c				
Relative vapor density (moist air)	Saturated at 20°C and 1 atm	1.51 ^b				
Air diffusion coefficient	cm ² /s at 20°C	0.0797 ^b				
Henry's Law constant	atm-m ³ /mol at 25°C	0.0302 ^b 0.0298 ^c				
Solubility in water	mg/L at 20°C, 1 atm	800 ^{ab}				
Dielectric constant		2.2 ^{ac}				78.5(a) 80.4(c)

^aRohay and Johnson (1991).

^bCohen et al. (1993).

^cPankow and Cherry (1996).

^dLast and Rohay (1993).

DBBP = dibutyl butyl phosphonate

TBP = tributyl phosphate

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